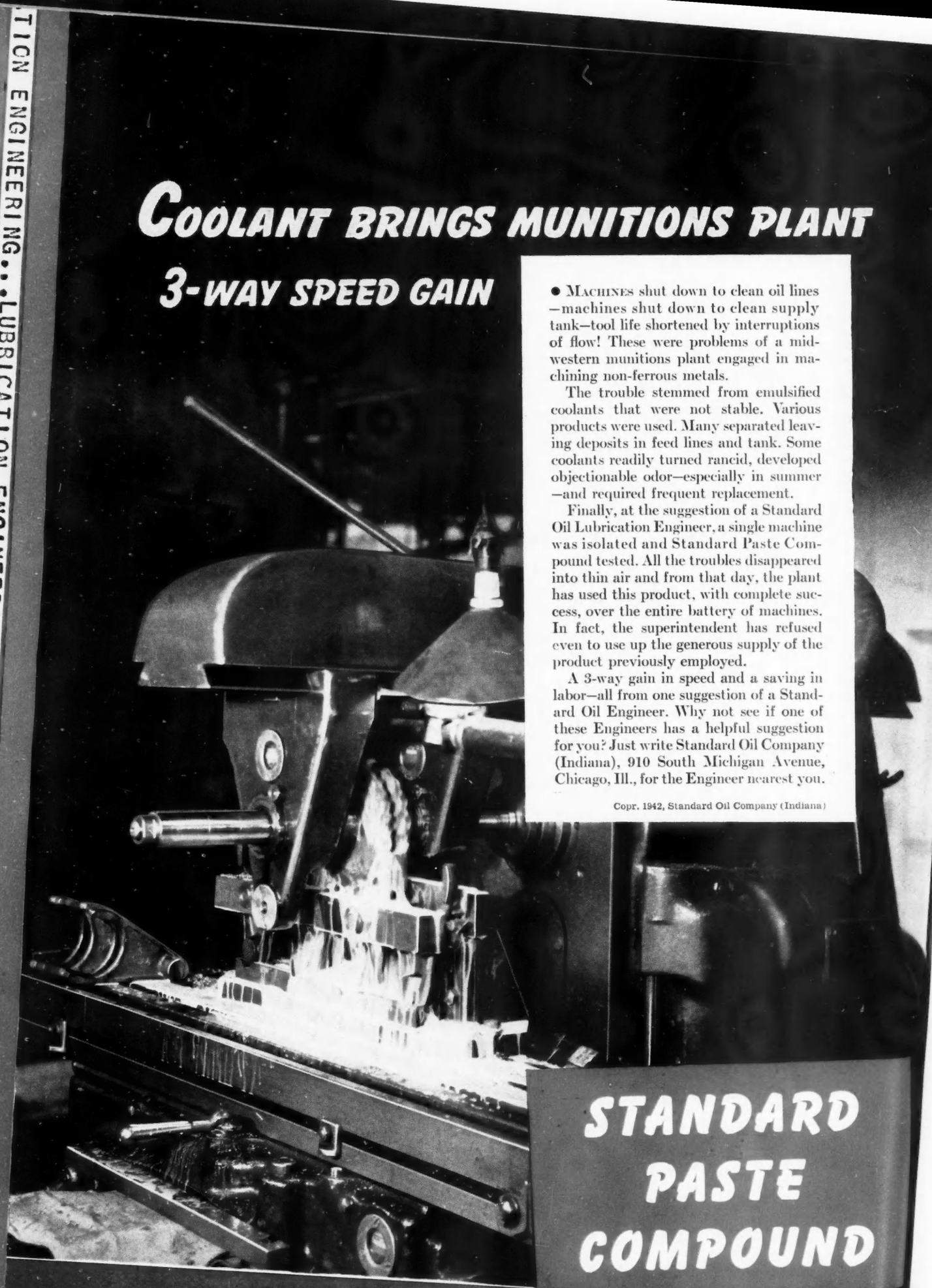
AUTOMOTIVE and Aviation INDUSTRIES

APRIL 1, 1942

COOLANT BRINGS MUNITIONS PLANT 3-WAY SPEED GAIN



● MACHINES shut down to clean oil lines —machines shut down to clean supply tank—tool life shortened by interruptions of flow! These were problems of a mid-western munitions plant engaged in machining non-ferrous metals.

The trouble stemmed from emulsified coolants that were not stable. Various products were used. Many separated leaving deposits in feed lines and tank. Some coolants readily turned rancid, developed objectionable odor—especially in summer —and required frequent replacement.

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AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly

Volume 86 Number 7

CONTENTS

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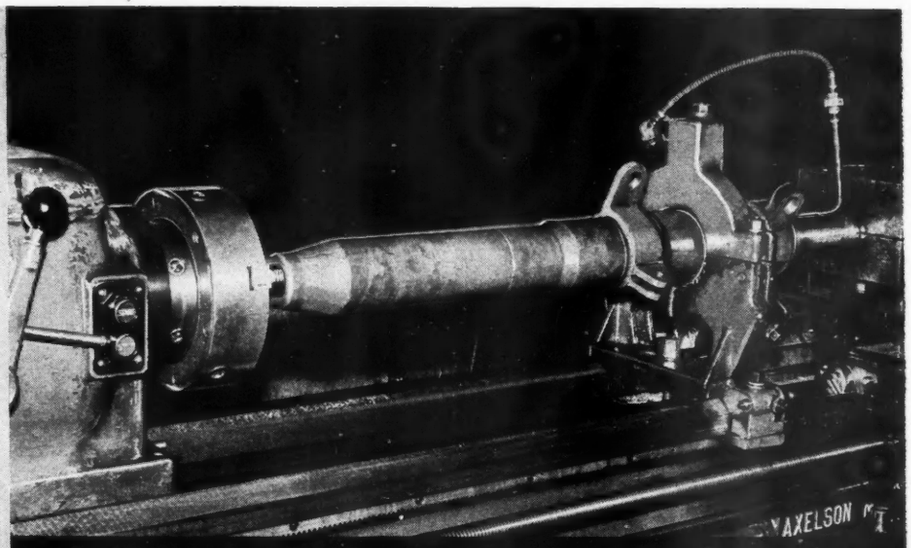

BORING IN ENGINE LATHE . . . on a similar aviation manufacturing operation as shown here, *Texaco Transultex Cutting Oil* improved the finish, increased the life of the boring tool . . . the operators liked the color and the lack of odor.

AVIATION manufacturers are "keeping 'em rolling" so that the boys can "keep 'em flying." Gigantic plants, machine shops, assembly lines . . . specialized machine-tools, high-speed, streamlined methods are in general use.

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RETURN METAL DRUMS PROMPTLY . . . thus helping to make present supply meet industry's needs and releasing metal for War Needs.

IN THIS ISSUE . . . .

AUTOMOTIVE
and AVIATION
INDUSTRIES

Volume 86 April 1, 1942 Number 7

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Tank Ships Carry Bulk of Eastern Supply

For every tankship sunk or transferred from the Gulf-to-East-Coast service, other means of supply must be found for nearly 100,000 passenger cars or 35,000 domestic oil burners.

During 1940 the average tankship on the East Coast run carried 80,000 barrels of petroleum or petroleum products in each 20-day round trip. It delivered, therefore, the equivalent of approximately 4000 barrels a day. The 1,500,000 barrels, or 63,000,000 gallons, transported in one year by a tankship are about equal to 650 gallons per car for 100,000 passenger automobiles, or to 1800 gallons of fuel oil for each of 35,000 domestic oil burners.

In the same year, the East Coast area received 516,000,000 barrels of crude oil and petroleum products. Water-borne shipments accounted for all but 9,500,000 barrels; these were carried by pipe lines from inland points. Tank-car shipments were almost unheard of.

Aeronautical Engineering America's Trump Card

At the National Aeronautical Meeting of the SAE many new features in the design and manufacture of aircraft were brought out into the open. The innovations of today are the practices of tomorrow, so the digests of the papers presented at this meeting are a veritable look into the future. Read them.

Sterling Engine Production for War Boats

A lot of Sterling engines are in the boats of our navy. How they are being produced with such speed and in such quantities is a story well worth the time to read. You will find it of more than average interest.

Looking to Latin America for Rubber

One of the most vital materials for the successful outcome of the war is rubber. Here is an account of what we may expect from our neighbors to the south. This is the big question in production. Read this and be informed.

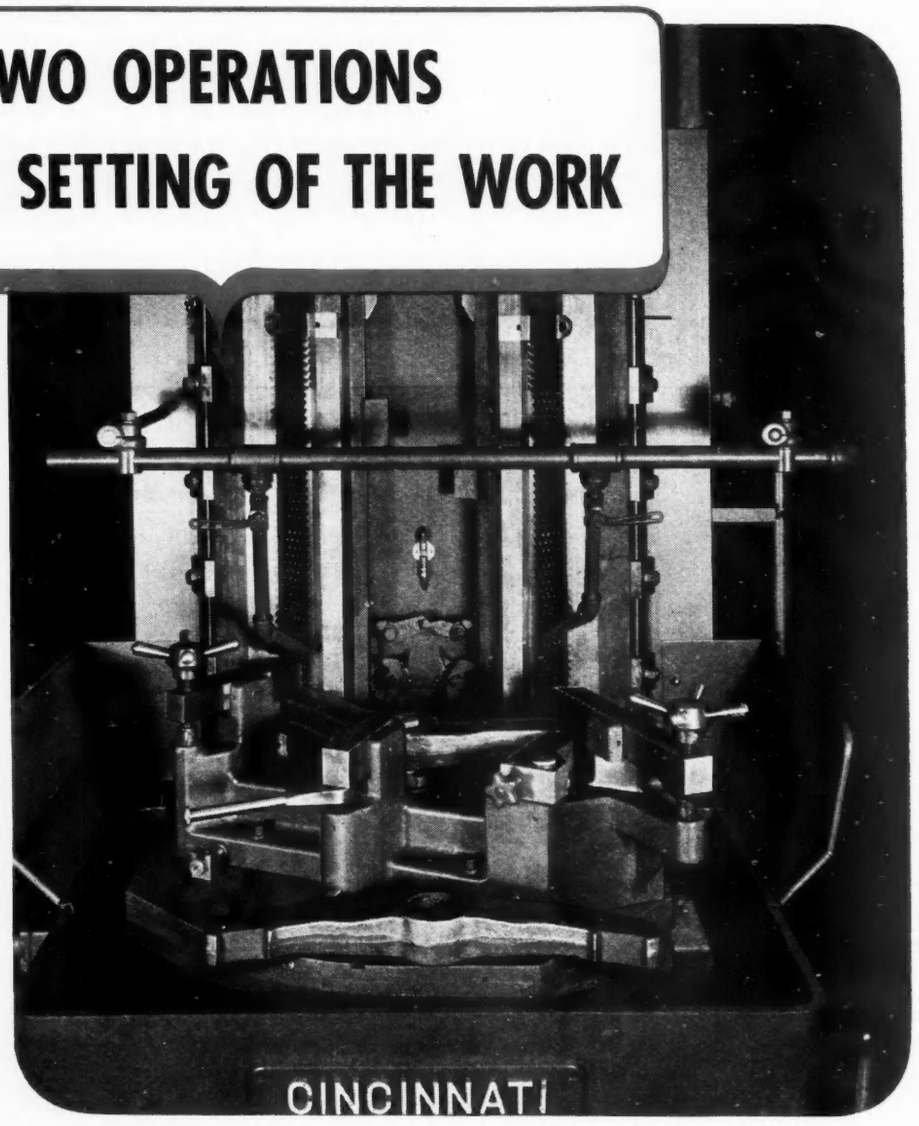
Sikorsky Helicopter

Igor I. Sikorsky has come forward with a new design in helicopters. It has an auxiliary rotor and has several advantages over his previous designs.

Metal Cleaning as of Today

Here is a subject that is one of foremost importance in the production of war equipment. So with the "all out for victory" impetus that has infected all production lines the "up on his toes" engineer will read this article very carefully. It may just be that your plant is not up to the mark that you thought it was.

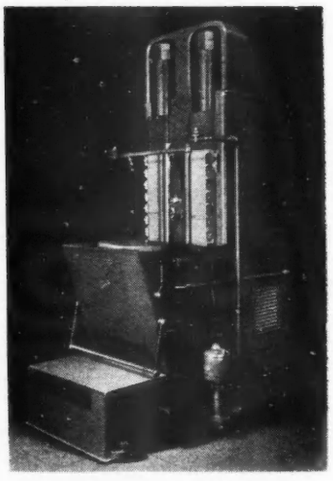
TWO OPERATIONS IN ONE SETTING OF THE WORK



THIS illustration shows a common-sense application of broaching to the more rapid production of war materials. The part requires two operations; both of which are completed in one setting of the work . . . an ordinary procedure with many machine tools but an innovation in the rapid broaching process.

A recess approximately 1/4" deep is broached in each end of the part, a heavy steel forging, at the rate of 45 parts per hour. The machine —a CINCINNATI No. 10-66 Duplex Vertical Hydro-Broach.

The illustration is practically self-explanatory, and much of the credit for the success of this operation goes to the exclusive CINCINNATI swivel table arrangement. Why not consider unconventional—and perhaps more readily obtainable—machines for increasing your war-time production? In surface broaching, look to CINCINNATI for recommendations.



CINCINNATI No. 5-42 Duplex Vertical Hydro-Broach Machine. Complete description and specifications given in catalog M-894.

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AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st and 15th of the month

Vol. 86, No. 7
April 1, 1942

Solving the

Huge Machine Tool Problem

of Conversion

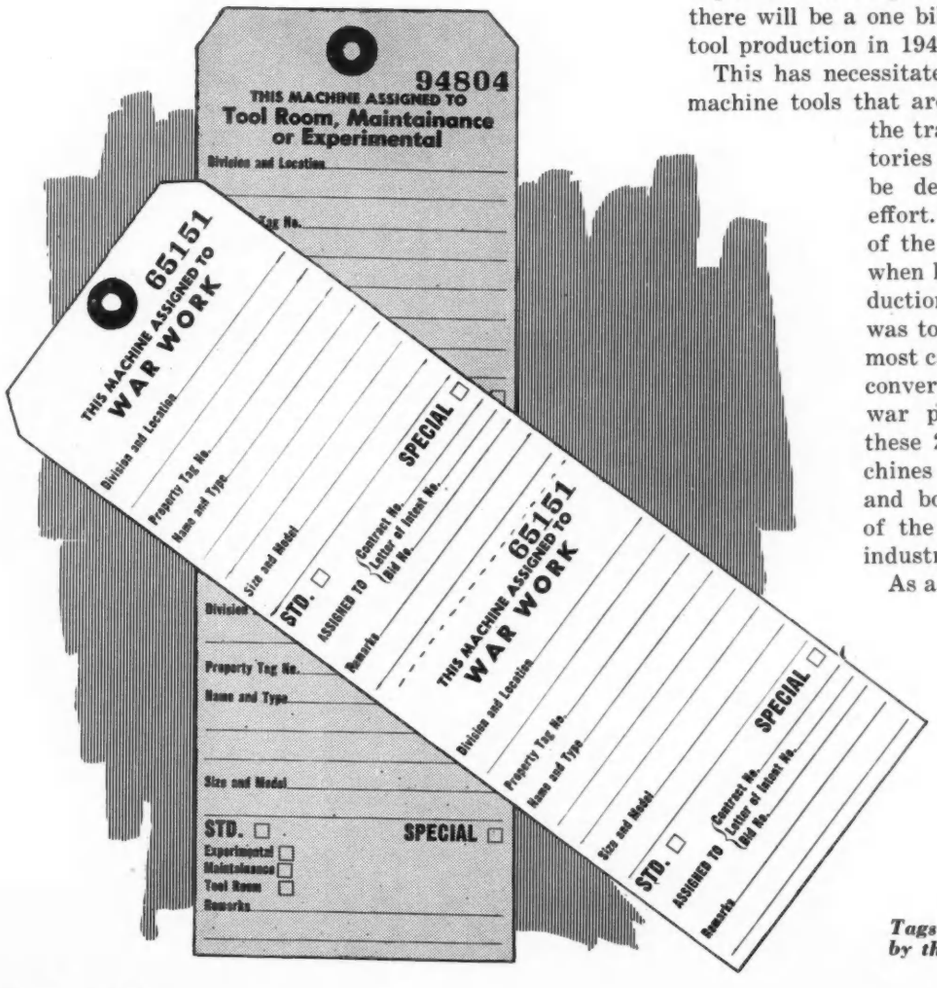
By E. L. Warner, Jr.

MACHINE tools present one of the major problems in converting the automobile industry from peace-time to war production. Many special purpose machines in the automotive industry are not adaptable to armament work because the manufacture of airplanes, tanks and guns calls for different techniques. Mechanical ingenuity of the automotive engineers has resulted in the adaptation of many machines to the output of war products. But many new machines also are required and, despite a tremendous expansion of output by the machine tool industry, there will be a one billion dollar shortage in machine tool production in 1942.

This has necessitated the utmost utilization of the machine tools that are now on hand and it calls for the transfer of machines between factories so that all facilities possible will be devoted to expediting the war effort. To speed the tooling effort, one of the first acts by Ernest C. Kanzler when he became chief of the War Production Board's Automotive Branch was to initiate an inventory of the 20 most critically needed machine tools in converting the automotive industry to war production. A request to list these 20 types of metal-working machines went to all automobile, truck and body manufacturers and to 150 of the largest parts suppliers in the industry.

As a result of that survey, the Automotive Branch now has a file of 35,500 machines of the critically needed

(*Turn to page* 64 *please*)



Tags are attached to machines affected by the conversion program at General Motors.

Aeronautical Engineering,

AERONAUTICAL engineering is America's trump card for victory, research the great hope for the winning of the peace.

That was the theme of the inspiring address delivered by Ernest E. Wilson, United Aircraft Corp. president, at the National Aeronautic Meeting, which was sponsored by the Society of Automotive Engineers on March 12 and 13 in New York City. Hundreds of executives, engineers and other technical men from the aircraft and automotive companies attended the two-day technical sessions, which were devoted to current problems in connection with aircraft and their powerplants.

Ralph S. Damon, president of the Republic Aviation Corp., was the toastmaster at the dinner concluding the meeting. During the evening the S.A.E. Wright Brothers Medal was presented to Samuel J. Loring, an engineer with the Vought-Sikorsky Division of the United Aircraft Corp., by Dr. J. C. Hunsaker, chairman of the National Advisory Committee for Aeronautics. It was his paper, "General Approach to the Flutter Problem," which he read at the S.A.E. meeting a year ago, that won for him this award.

An added feature was a discourse by Percival Knauth, former Berlin and Berne correspondent of the New York *Times*, who spoke on the subject, "Germany in the Third War Year." Based on his observations while in Europe until his return to this country a few months ago, he diagnosed the weaknesses of the home front and military machine of Germany and outlined where vital blows could be struck against them.

Mr. Wilson, who for the past 12 years has directed the huge industrial organization that builds Pratt & Whitney engines, Hamilton Standard propellers and Vought-Sikorsky Pan American clippers and warplanes, credited aeronautical design engineers of the country with having made available upon the outbreak of war designs of aircraft superior to those of the enemy. This objective, he said, was realized in a country long committed to a policy of peace, even to pacificism, another crystal-clear indication of the superiority of American freedom of initiative and enterprise.

To the aeronautical production engineer was ascribed the accomplishment of flexible production to meet the emphasis on performance. In the air transport system, he pointed out, the criterion is cost-per-ton-mile, in the military field the standard is speed, climb and ceiling. As a result, Mr. Wilson stated:

"The machine tools had to be capable of quantity production, but, at the same time, they had to be flexible, and permit frequent and rapid changes in design. Beyond this, the precision requirements were much more exacting, because of the high stresses involved. This called for the use of standard precision tools, but with special jigs and fixtures. It tended to place a premium upon the use of automatic controls, making the machine more foolproof and less exacting in so far as skilled operation was concerned.

"And so, aeronautical production engineering grew up around this flexible tool philosophy. It had two important results: (1) That when the expansion program was initiated, the requirements were for standard tools and the machine tool industry was able to go into quantity production on standard or semi-standard models, instead of limited special production on special machines; and (2) in the training of operators, the use of automatic equipment greatly simplified the problem. These things enabled the aircraft industry to expand with great rapidity, and thus more rapidly meet the immediate needs. By the same token, it decreased the time required for the automotive or other industries to convert their shops to aircraft production."

Comparison of Specifications and Performance—Junkers 211-B Engine and Its Contemporaries

1. Make	Mercedes Benz	Allison	Rolls Royce	Hispano Suiza	Jumo
2. Model	DB-601A	V-1710C-15	Merlin X	12Y-51	211-B
3. Number of Cylinders	12	12	12	12	12
4. Arrangement	Inverted Vee	Vee	Vee	Vee	Inverted Vee
5. Bore (In.)	5.7	5.5	5.4	5.9	5.9
6. Stroke (In.)	6.3	6.0	6.0	6.7	6.5
7. Piston Displacement (Cu. In.)	2070	1710	1647	2197	2132
8. Military Rating (Hp)	1000	1090	1025	1100	975
9. Military Rating (rpm)	2400	3000	3000	2400	2300
10. Military Rating Altitude (Ft)	14760	13200	17750 (High Blower)	10696	
11. Hypothetical Hp at 15000 ft	990	1020	1150	920	990
12. Take-Off Rating (Hp)	1150	1040	1045	1100	1100
13. Take-Off Rating (rpm)	2500	3000	2850	2400	2400
14. BMEP (Military Rating)	158	168	164	156	157
15. BMEP (Take-Off)	167	160	176	166	170
16. Compression Ratio	6.8	6.65	....	7.0	6.56
17. Take-Off Piston Speed (Ft per Min.)	2625	3000	2850	2690	2600
18. Total Piston Head Area (Sq. In.)	306	285.5	275	328	328
19. Take-Off Horsepower per Square Inch Piston Area	3.84	3.65	3.81	3.36	3.36
20. Take-Off Horsepower per Cubic Inch Displacement per Minute	.000111	.000101	.000111	.000104	.000107
21. Dry Weight (Pounds)	1367	1325	1394	1085	1510
22. Dry Weight per Unit Displacement (Lb. per In^3)	.66	.775	.845	.493	.708
23. Unit Weight (Pounds per Take-Off Horsepower)	1.19	1.27	1.33	.995	1.37
24. Height (Inches)	40.5	42.1	41.1	37.2	42.5
25. Width (Inches)	29.1	30.6	29.8	30.1	31.0
26. Overall Length (Inches)	84.0	94.5	75.1	84.1	69.7

By James R. Custer

America's Trump Card

So Said President Wilson of United Aircraft Corp. at the S. A. E. National Aeronautical Meeting. Timely Technical Papers on Aircraft and Aircraft Engines Were Presented at the Two-Day Sessions.

The three sessions of the first day were given over principally to aircraft engine papers with the one on the Junkers Jumo 211-B powerplant highlighting the morning meeting, which was in charge of C. F. Bachle, S.A.E. vice-president for aircraft engine activity.

At the afternoon session, with R. F. Gagg, Wright Aeronautical Corp., the chairman, there was a symposium on the production testing equipment at the Packard, Allison, Buick and Ford aircraft engine plants. Of particular interest was the various methods used to advantage for the same purpose. F. A. Dietz reported on Packard's water-cooled, eddy current dynamometer system for testing Rolls-Royce Merlin engines. C. A. Chayne, of Buick, and W. H. Hedley, Ford representative, reviewed their techniques for testing Pratt & Whitney engines on electric dynamometers with the power recovery feature. In his paper H. J. Buttner told why controllable pitch propellers are used to absorb the power of Allison engines on the production test stands.

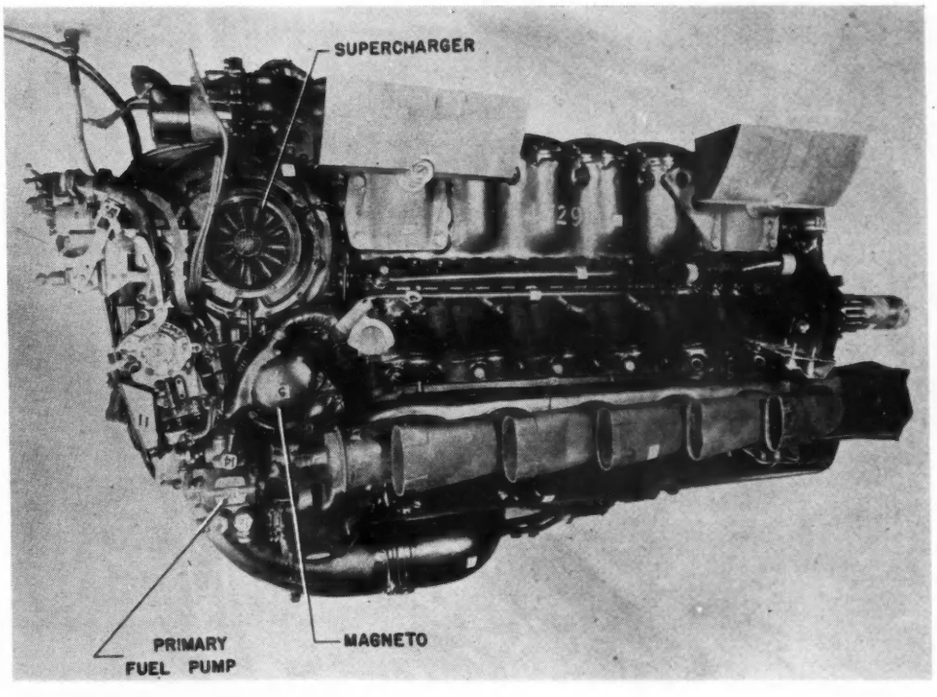
At the evening session fuel consumption from the viewpoint of the airlines and crash proof fuel tanks were the topics. J. G. Lee, United Aircraft Corp., was the chairman.

At Friday's morning session, which was presided over by Peter Altman, S.A.E. vice-president for aircraft engineering, Willson H. Hunter of the B. F. Goodrich Co., analyzed aircraft icing and its prevention. Aircraft hydraulic systems and their operation were explained by Lieut. Harry J. Marx, of the Bureau of Aeronautics. In the afternoon impact resistance windshields and engineering problems in cargo transportation were discussed with William Littlewood, vice-president of American Airlines, in the chair.

Abstracts of the papers read at the various technical sessions are given here.

Junkers Jumo 211-B Aircraft Engine

THE results of an exhaustive study of a Junkers Jumo 211-B aircraft engine by Chrysler engineers were contained in the paper prepared by Sidney Oldberg and Thomas M. Ball. Although the engine examined is not the latest model of the Jumo 211 series, it is considered representative of the basic design being employed by the Junkers engineering staff. It was removed from a captured German Ju-88 twin-engine bomber and shipped to this country by the Army Air Corps. The Junkers 211 engine, one of the three high output liquid-cooled engines being produced in Germany, also powers the Heinkel He-111, twin-engine bomber, and the Junkers Ju-87, single engine dive bomber. Originally introduced in 1937 with a carburetor fuel system by its makers, the Junkers Flug-



Starboard side of the Junkers 211-B engine.

Weights of Junkers 211-B Parts

	Lb.	Oz.
Crankcase (bare)	232	0
Crankcase upper cover plate	18	4
Crankcase lower cover plate	6	9¼
Two cambox and head assemblies including cambox covers	321	0
Eight main crankshaft bearings and caps	21	5¾
Twelve piston and rod assemblies with bearings	149	4½
Rear assembly with gear train	109	4½
Supercharger assembly	40	0
Supercharger controls and throttle	11	10¼
Oil pump and filter	13	7¼
Reduction gear and shaft assembly (without prop. shaft)	71	7¼
Two magnetos and line assemblies	42	8
Crankshaft	164	1
Crankshaft gear	16	12
Crankshaft gear nut, tapered rings, and locks	2	6
Primary and secondary fuel pumps	60	0
Twelve cylinder barrels	105	6
Water pump assembly	10	14¼
Misc. lines, tubes, nuts and brackets	113	7
Rating Weight	1509	11
Parts not included in RATING WEIGHT:		
Four engine mountings	24	0
Generator	25	0
Starter	34	12
Exh. stacks and cowling brackets	67	8
Propeller shaft	16	13
Total Weight	1677	12

zeug-Und-Motorenwerke, A. G., of Dessau, direct cylinder injection was incorporated in it during the next year.

In this abstract is included a tabulation of weights, performance and specification data, and a material analysis of the Junkers 211-B engine. Design features of the parts will be given in the April 15 issue of AUTOMOTIVE *and* AVIATION INDUSTRIES. In a general appraisal of the engine, the following observations have been made:

1. While the external appearance and displacement resemble the Daimler-Benz 601 Series, in that it is a 60-deg. inverted-Vee with direct gasoline injection, the fundamental construction, detail design practice, and metallurgy of the Junkers 211-B is surprisingly different. No parts appear to be common to the two engines excepting, possibly, the starter and generator.

2. The general arrangement is logical and simple, although the manufacturing complications of several parts indicate an enviable ascendency of the designer over the production department. The solution of typical design problems of optimum stress distribution is carried to the most minute details.

3. In general, the engine was manufactured with care and precision. Parts expected to require service replacement appear to be interchangeable, although the machining errors in certain large castings were found to have been corrected by hand working in the mating pieces. Surface finish and dimensional uniformity of like parts equals American practice, with but few exceptions.

4. The materials analyzed betrayed little shortage of strategic alloying elements, contents of these averaging close to American aircraft practice. In general, the steels used were drawn to hardnesses far below their usable upper limits, contrary to usual American practice. Whether soft to expedite machining or to decrease notch sensitivity, the physical properties observed in many of the steels could have been obtained more economically.

5. As shown in the accompanying table, the specifications of the engine and a comparison with its contemporaries, the Junkers 211-B follows the usual German practice of very large displacements and conservative mean effective pressures and rotative speeds. However, the relatively light weight per unit of displacement results in a net weight per horsepower that is not far above its competitors.

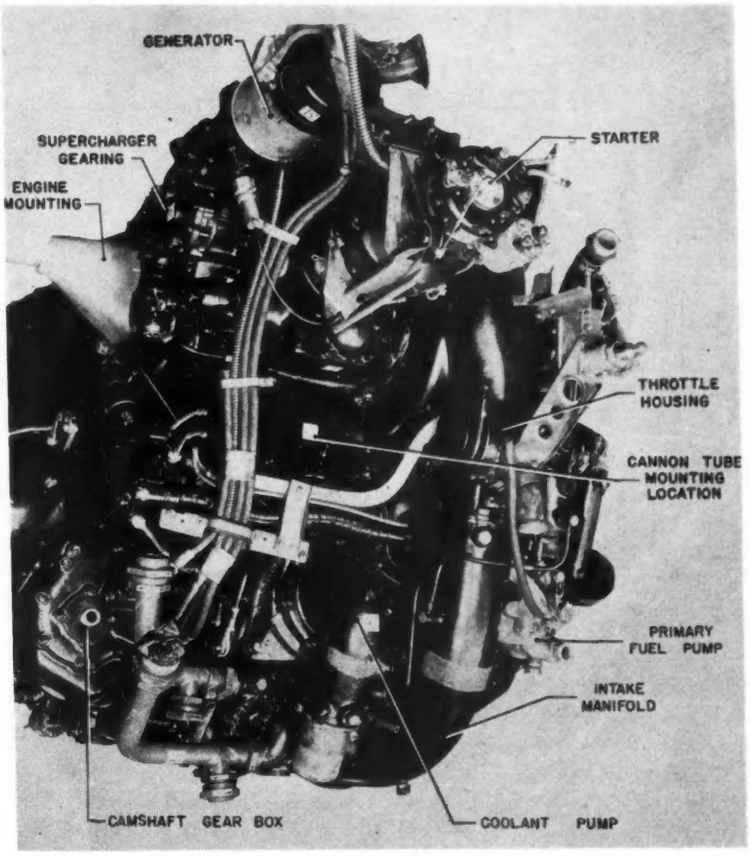
6. Fully automatic devices which controlled propeller speed, manifold pressure, mixture ratio, spark advance, and supercharger gear ratio follow the German policy of removing all possible distractions from the pilot.

The known installations of this engine are bulkhead mounted. The front section of the nacelle, the oil cooler and a horseshoe-shaped coolant header were supported on the engine. In some installations the radiator is directly below the engine, although from the parts examined the method of attachment was not clear. Line connections to the pilot's compartment were mostly jointed at the firewall, and all lines were color coded.

Material Analysis of the Junkers 211-B

Part	Brinell Hardness	Fe	Si	Mn	Mg	Al	Cu	C	Cr	Ni	Mo	Va	Others
Injection Plunger	550	Base	0.27	0.38	....	....	....	0.19	0.80	3.7	....	....	....
Injection Barrel	700	Base	0.27	0.38	....	....	....	0.24	....	....	....	....	....
Accessory Drive Housing	95	0.12	9.63	0.41	0.19	Base	....	....	....	....	....	....	....
Main Bearing Cap	110	0.55	0.79	0.96	1.08	Base	3.99	....	....	....	....	....	....
Main Bearing Cap Stud	305	Base	0.31	0.57	....	....	....	0.29	2.01	1.91	0.20	0.11	....
Camshaft Bearing	40	5.65	0.44	0.08	0.74	Base	0.28	....	....	....	....	....	....
Camshaft	404	Base	0.21	0.53	....	....	....	0.33	1.51	1.89	0.29	....	....
Camshaft Drive Gear	313	Base	....	0.61	....	....	....	0.11	2.12	1.83	0.23	....	....
Coolant Pump Housing	60	0.81	11.13	0.34	....	Base	0.64	....	....	....	....	....	0.03 Zinc
Coolant Pump Impeller	....	0.32	1.71	0.17	4.43	Base	....	....	....	....	....	....	0.03 Zinc
Connecting Rod	362	Base	0.26	0.37	....	....	....	0.31	1.86	2.00	0.30	....	....
Front Crankcase Cover Plate	....	0.59	....	0.29	Base	3.64	....	....	....	....	....	....	1.14 Zinc
Crankshaft	311	Base	....	Trace	....	Trace	Trace	0.62	0.41	1.63	0.24	....	....
Cylinder Head	95	0.65	10.05	0.03	Base	....	....	....	....	....	....	....	0.63 Cobalt
Cannon Barrel Idler Gear	....	Base	....	0.44	....	....	....	0.20	2.11	1.91	0.22	....	....
Generator Drive Gear	....	Base	....	0.39	....	....	....	0.10	0.91	4.49	....	....	....
Main Reduction Gear	650	Base	0.22	0.53	....	....	....	0.13	1.93	1.85	....	....	....
Motor Hanger	123	0.37	1.13	0.75	0.40	Base	3.90	....	....	....	....	....	....
Piston	80–105	0.49	12.22	0.05	0.75	Base	1.06	....	....	0.61	....	....	....
Piston Pin	555	Base	0.29	0.66	....	....	....	0.19	1.85	2.16	0.19	....	....
Piston Pin Plug	....	0.10	....	0.38	Base	3.18	....	....	....	....	....	....	1.00 Zinc
Piston Pin Bushing	179	Base	1.40	0.89	....	....	0.10	3.25	....	....	....	....	....
Exhaust Valve	210	Base	2.00	0.55	....	....	....	0.48	13.92	12.30	....	....	....
Exhaust Valve Seat Facing	470	Base	1.8	0.86	....	....	....	....	28.44	....	....	....	3.1W, 56.3Co
Intake Valve	240	Base	1.72	0.30	....	....	....	1.65	14.05	....	....	0.30	....
Valve Seat Insert	200	Base	....	0.70	....	....	....	0.50	1.58	....	....	....	....
Supercharger Impeller	....	....	....	0.16	Base	6.90	....	....	....	....	....	....	1.34 Zinc
Crankcase	....	0.46	9.96	0.47	0.23	....	0.03	....	Trace	0.002	....	....	0.1Ti, 0.03Zn 0.024 Sn 0.005 Pb

The compact accessory grouping at the rear of the Junkers engine.



Notable are the compact accessories section, the high mounting location, and the amount of external plumbing, particularly in the Vee. Lengthwise, the engine is compact, having 6.62 in. cylinder centers with a 5.9 in. bore.

Materials: Alloying content of steel, while lower than that of British and French steel, is comparable to American practice. One remarkable exception is the extremely high chromium content of chrome-nickel-molybdenum steels. The manufacturers have been generous in their use of chromium, have clung to the low side of the usual range of molybdenum, and have been moderately economical of nickel.

The other remarkable feature of these steels is that with few exceptions, they are used with a hardness and tensile property at the extreme lower end of their usual range. This may be due to: (1) A possible shortage of machine capacity, making it inadvisable to machine harder steels, or (2) A need for reduction in notch sensitivity.

Inclusions in major studs and tie rods seemed rather high. Heat treatment was good, care being taken not to carburize too deeply on this sections. Magnesium alloys were found in some quantity, as for example the reduction gear cover, supercharger housing, and piston pin plugs. This is in marked contrast to the DB601A, on which little magnesium was found. Aluminum castings are mostly of a high silicon type alloy similar to that used on the Daimler-Benz. The aluminum cylinder head contains cobalt in the amount of 0.63 per cent which was not present in the other aluminum parts.

Aircraft Hydraulic Systems

A HIGHLY informative paper on the subject, "The Growth and Development of Aircraft Hydraulic Systems and Equipment," was prepared for the meeting by Lieut. Harry J. Marx, of the Bureau of Aeronautics, and Edward M. Greer, of Simmonds Aerocessories, Inc. For many of the present airplanes, they stated, only a fairly simple hydraulic system of the power valve type is required (Fig. 1). In this circuit, a power control valve is employed between the pump and the hydraulic components. This particular type of valve may be designed in various ways, but it is essentially a hand shut off valve which closes off a by-pass from the pump directly to the reservoir allowing the power to build up in the system and contains an automatic means of opening the by-pass after a predetermined pressure is built up.

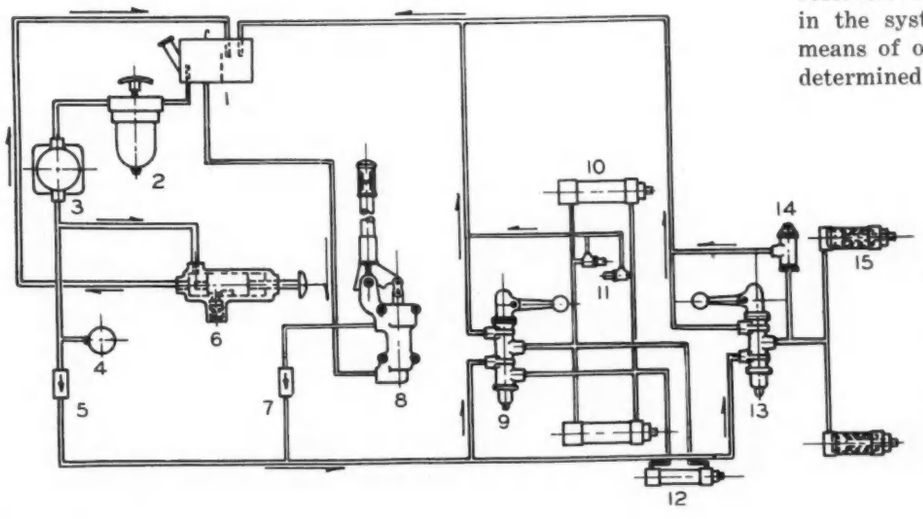


Fig. 1—Power valve system as used in many current airplanes.

1—Resevoir
2—Strainer
3—Pump
4—Surge chamber
5—Check valve
6—Power valve
7—Check valve
8—Hand pump
9—Landing gear valve
10—Landing gear cylinder
11—Temperature relief valve
12—Tail wheel cylinder
13—Flap valve
14—Flap relief valve
15—Flap cylinder

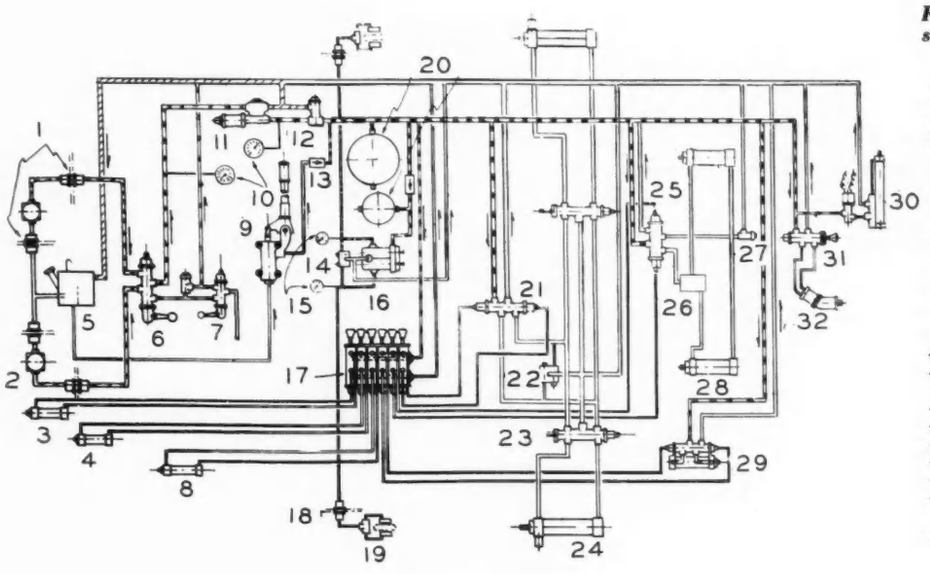


Fig. 2—Comprehensive hydraulic system with pilot-operated hydraulic valves.

1—Line disconnect valves
2—Pump
3—Right hand oil cooler shutter
4—Left hand oil cooler shutter
5—Resevoir
6—Engine selector
7—Automatic pilot valve
8—Cowl flap
9—Hand pump
10—Gages
11—Unloader valves
12—Relief valve
13—Check valve
14—Relief valve
15—Break gages
16—Break valve
17—Manifold pilot valves
18—Line disconnect valve
19—Break shuttle valve
20—Accumulators system and break
21—L. G. Selector valve
22—Temperature relief valve
23—Emergency dump valve
24—Landing gear automatic lock
25—Flap selector valve
26—Flow divider
27—Relief valve
28—Flaps
29—Bomb door operating valve and cylinder
30—Gun charger
31—Turret variable flow valve
32—Turret motor

As the use of hydraulic equipment becomes more extensive, automatic regulation and operation with the least amount of effort from the pilot becomes imperative. A complete and comprehensive system illustrating this type of actuating equipment is shown in Fig. 2. This system can be broken down into four parts: (1) The power supply; (2) pressure regulation and storage; (3) directional control valves, and (4) actuating cylinders and motors. The schematic diagram here illustrated, demonstrates a case of multiple pump installation. A three-way selector valve is installed in the pressure line so that either pump can serve the hydraulic or direct the flow into the hydraulic system. Since the pump is directly connected to the engine, and, therefore, running during the whole time that the engine is in use, an unloader or pressure regulator valve is placed between the pump and the system. The system here illustrated, although not a typical installation and is not used on any known aircraft application, is used in this form rather than to show an existing system which might disclose military information.

There are combinations of electric hydraulic systems where solenoid operated valves (Fig. 3) are used in the same manner that the pilot operated hydraulic valves shown in Fig. 2 are employed. This type of valve has not been used very much to date, but it is predicted that very soon, they will find wide application in the aircraft industry. The main difference in such a system, referring to Fig. 2, is that electric switches would replace the hydraulic valves, and instead of hydraulic lines running to the main selector valves, electric wires would run to solenoids mounted on the valves to do this job. The big objection to this sort of system is the objection to any electrical arrangement and that is that the solenoids themselves are very heavy and, therefore, in many cases the weight alone is a factor to prohibit their use.

During the past two years rapid strides have been made in the application of hydraulic actuating equipment in aircraft. It should be realized that although commercial airplanes have employed hydraulic actuating equipment on landing gear, wing flaps, brakes and the automatic pilot, there was no real extensive use of hydraulic mechanisms until the design of military aircraft reached its peak.

Further applications of hydraulic operation include motivation of bomb bay doors on the ground for loading the bombs and in the air to release them. Another hydraulic application to armament is gun turret controls which in many cases are operated by separate systems. It should be here stated that frequently gun turrets are electrically operated due to the constant operation requirements which are impractical with a hydraulic actuating cylinder. However, with the development of hydraulic motors hydraulic application to gun turrets is finding its place today. Hydraulic application to machine gun chargers is rather old in the

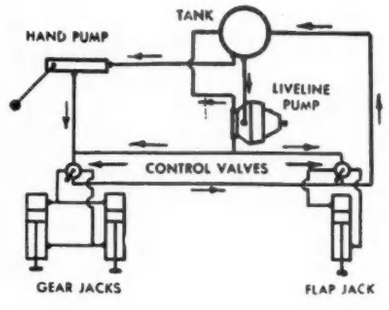


Fig. 3—Solenoid operated valves are finding wider application particularly in England for replacing hydraulic valves.

industry. However, a great many refinements have been made in the past year as high altitude flying has required gun chargers to be actuated at extremely low temperatures in an extremely short period of time. One of the greatest developments of modern aircraft with respect to hydraulics has been in the operation of dive flaps. Many problems are still unsolved in their application. To go a bit further in the use of hydraulics in a military airplane, we should mention our new developments in folding wings and their timing, retractable wing tip floats and retractable main floats as used on our flying boats, the hydraulic operation of antenna masts, pitot tubes, hydraulic tab controls and arresting gear hooks.

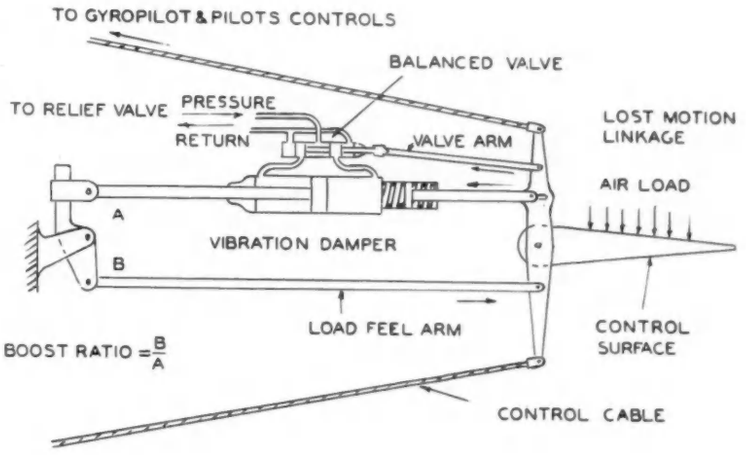


Fig. 4—Schematic diagram of load feel booster system

Also in our very large airplanes it has been found necessary to apply hydraulic operation to surface controls. This is a field of hydraulics in itself as in order to maintain the fuel of the action which is necessary to the pilot, the development of booster cylinders has been introduced. The Douglas Aircraft Co. has done a considerable amount of work in this direction and has developed a surface control booster system which is now being aplied in their largest aircraft. This system (Fig. 4) is designed so that the pilot feels only a fraction of the resistance force in operating or changing his surface controls, the rest of the load being taken up in the booster system.

With the elimination of the problems of sealing, shrinking, and we should add—distortion, we are eliminating the necessity for adjustment of the packings in the cylinder units. The latest development to reach us on this problem of packings has come from France and is known as the Simmonds-Olaer metallic gland. This gland is designed so as to eliminate the use of synthetic rubber packings entirely and substitute a bronze gland having an elastic lip to seal against leakage and pressure. Many tests have been made in this country to date on these glands and we have found that although they are much higher in friction than non-metallic glands, they are dependable at pressures from zero up to 10,000 lb. per sq. in. and have proven satisfactory at temperatures ranging from 200 deg. above zero and down to 200 deg. below zero. This particular seal is now looked upon strictly as a high pressure sealing member.

Allison Production Testing Facilities

AFTER considering the various types of power absorbing equipment for the production testing of Allison aircraft engines, controllable pitch propellers were selected primarily because operating conditions with them would more closely approach those of flight, it was explained by H. J. Buttner in his paper describing the production test facilities at the General Motors Allison plant. Thus engines would be subjected to lateral movements and torsional vibration as in an airplane, an assumption that was proved by defects which appeared in engines tested with flight propellers after a quantity had been production tested on a dynamometer.

Other factors entering into a decision against dynamometer equipment included the relative ease of obtaining propellers instead of dynamometers, the ease of maintenance of propellers and their record of long life in aircraft operation, the difficulty of designing or obtaining couplings that could be relied on for continuous use, the great quantities of cooling water required for electric eddy current absorption dynamometers or water brakes and finally the ease and simplicity of installation and operation of the engine.

General Building Arrangement and Construction: The general plan consists of pairs of engine rooms with a common control room between each pair. The engine rooms are 20 ft. square in cross section and 80 ft. long. The walls in the square throat are of reinforced concrete as a protection to personnel from possible danger should a propeller blade fail. The control rooms are 20 by 28 ft. exclusive of the previously mentioned oil rooms which project into the control room.

Engine Stands and Mounts: Natural resonance of the stands has not caused a fraction of the trouble that so-called "gust conditions" have. This is particularly true in U-shaped stands having vertical intake and exhaust stacks. In some cases where there has been continuous endurance operation, it has been necessary to resort to an air-straightener for propeller air. The usual circular throat track or tunnel was found to be very inefficient for this unless a great length/diameter ratio of the throat is used which proves impractical in most stands.

A simple procedure, which has proven highly satisfactory, in straightening air consists essentially of a plate having a bore slightly less than the propeller diameter. This plate is located close to the trailing edge of the propeller. There is no back-flow of air in stands equipped with this device. The velocity of air through the cell is much greater than is the case when no such device is used.

Concrete stands are now used exclusively for all new construction. The engine mounts consist of cast iron bases carrying rubber bushings at four points to which the engine is attached. The rubber bushings greatly facilitate installation of the engine since there is little danger from distortion of the engine as would be true when bolting to rigid structures.

Heat Exchangers: Engine lubricating oil, coolant, and carburetor air temperatures are controlled through use of copper tube heat exchangers. Cooling water is carried around the tubes of the glycol cooler and then through the tubes of the oil cooler. A thermostat controls the discharge water temperature. This procedure permits rapid warm-up of the engine and results in economical use of water. The carburetor air

is heated in winter by one set of steam coils. Temperature regulation is achieved by controlling flow of water through a separate set of coils.

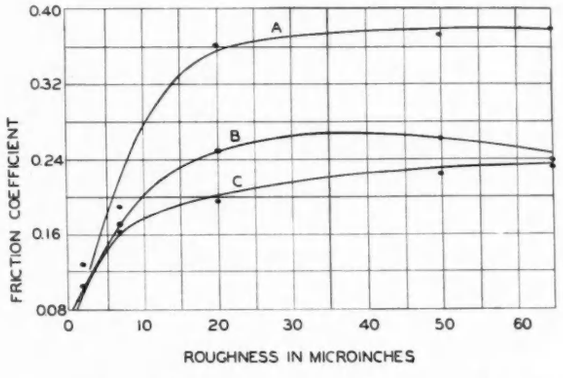
Plumbing: Great care has been taken to provide piping that could be easily disassembled and cleaned. Bolted flange connections are used throughout on both the glycol and oil systems. The oil system is composed of brass and hard copper pipe and fittings having sweated joints. The problem of dirt in the lubrication circuit has been responsible for the adaption of this type of plumbing. The care taken has been well worth while in that costly replacement of parts due to scratches has been reduced to a minimum.

Weighing Equipment: Venturi meters were selected for measuring air flow to permit recovery of pressure loss encountered in fixed orifices or to eliminate the continuous changes required of smooth approach orifices to maintain pressure drops to a narrow range. With the venturi it is possible to use one size of throat for engines requiring maximum air flows varying as much as 30 per cent and yet permitting sufficient accuracy in the low cruise power range. Most accurate results of fuel weighing are achieved by the null-weight system of running out fuel from a tank mounted on postal type scales and hanging a known weight on the tank after the scale trips and recording the time required for the scale to again trip. Various types of rotameters are available providing more rapid and safer means of measuring fuel flow and are sometimes more accurate than makeshift equipment used for calibration. Oil consumption and flow are determined by change in weight of a tank mounted on a scale. Flow readings are determined by trapping scavenge oil in an overhead tank and checking the time required to flow a given quantity from the scale tank.

Surface Chemistry and Profile in Boundary Lubrication

THE contrast between full fluid or hydrodynamic lubrication and "boundary" or thin-film lubrication was clearly drawn in a paper, "The Role of Surface Chemistry and Profile in Boundary Lubrication," presented by J. T. Burwell of the Massachusetts Institute of Technology. Although such bulk properties as hardness and thermal conductivity of the bearing metal, heat capacity of the oil, etc., enter into discussions of either kind of lubrication, Mr. Burwell contended that the structure and the chemistry and geometry of the interface between the oil and metal surface were most important in dealing with problems of boundary lubrication.

By covering separately the bearing surface, the energy of adhesion (loosely "wettability") and molecular structure of the lubricant, and the concentration of surface active material, the author showed that a good boundary lubricant should have the proper molecular structure, a high energy of adhesion, and the ability, imparted to the lubricant by some surface active ingredient in sufficient quantities, to cover quickly any spots on the bearing surfaces. In the presence of a good addition agent, he concluded, the effects of a poor surface finish are mitigated. Some results obtained in recent experiments are given in accompanying chart.



Effect of roughness of ground and superfinished surfaces on friction coefficient using different lubricants. Curve A pure mineral oil; Curve B mineral oil plus 2 per cent oleic acid; Curve C—pure oleic acid.

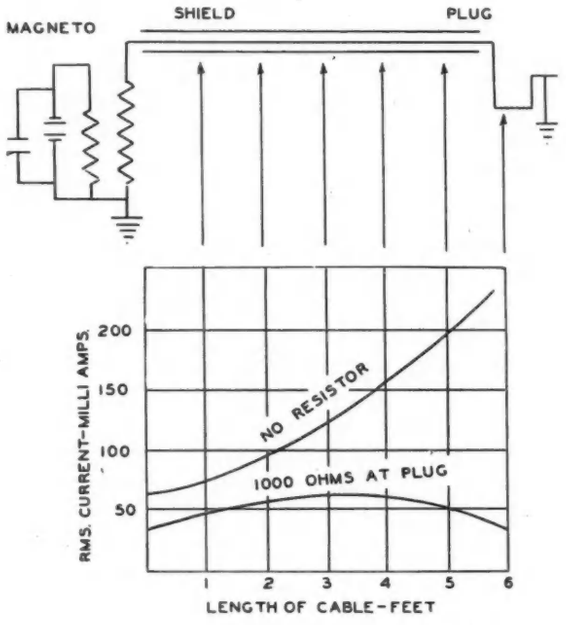
Ignition Shielding

IN a paper presented by D. W. Randolph of the Apex Electrical Mfg. Co., the author discussed the problems of aircraft engine ignition shielding which is absolutely necessary in any aircraft carrying radio equipment for communication and navigation. "How to secure a structure that will shield the high tension circuits while providing good insulation under severe conditions of vibration, temperature, altitude, and exposure is the problem."

Grounding points should be not more than 18 in. apart. With radio reception using high-sensitivity receivers operating on wave lengths as low as one or two meters, bonding or grounding is preferably done at more frequent intervals—not more than 9 in. apart. The use of shields having a specific resistance of more than 0.005 ohms per ft. also requires grounding at more frequent intervals.

Moisture, corona, and acid products of the decomposition of the air in the harness tubes vie with one another and with the reduction in the density of the air at higher altitudes in over-stressing and destroying the compact insulation inside the shields. A remedy is to maintain a pressure inside the harness sufficient to prevent the entrance of moisture or other liquids and at the same time to allow sufficient air leakage from the shield to carry off the products of corona or spark plug leakage before they have time to cause serious damage. The drawback to this system is the necessity of supplying a source of air under pressure which must be dried and piped to the harness connections. The added weight, complication and servicing required are justified in airline service, but are hard to provide in a military engine where space and weight are of more vital importance. Another solution that seems equally successful is the provision of a filling or sealing compound in which the individual conductors are embedded and by means of which air and moisture are excluded.

As the cable conductors pass through the shield to the spark plug they are surrounded completely by the grounded shield. Because the result is a large increase in capacity of each lead, an unwelcome additional re-



Average current in shielded ignition circuit as modified by damping resistor.

sponsibility is thrown on the magneto, and additional wear of the spark plug electrodes takes place. A method of reducing this wear is used in the KLG spark plug connector on the Rolls-Royce engine. This method involves the use of a small non-inductive resistor in the high-tension lead as close as possible to the spark plug. The resistor has no effect on the radio shielding properties of the harness assembly and is not to be confused with the high resistances used in motor car ignition circuits to minimize radio interference. The resistors used in aircraft magneto circuits have a resistance of from several hundred to a thousand ohms. They must be applied at a point near the spark plug as they depend for their effect on a reduction in the initial heavy current discharge across the plug gap which results from the sudden discharge of the capacity of the cable between the magneto and the plug. Fig. 1 shows typical results and a diagram of the electric circuits involved.

Future progress seems to lie in the use of improved shielding having no internal air spaces, in the use of improved plastic or ceramic insulators, and in the development of new ignition systems in which low voltage currents are carried to individual spark coils in or near the spark plugs to remove the necessity for high-voltage distribution. Rapid progress has been made in recent months toward these objectives.

Crashproof Fuel Tanks

THE problems involved in developing crashproof fuel tanks and what has been accomplished within the past year as the result of a revival of interest in them for civil aircraft, particularly for transports, was reviewed by J. W. Baird, of the Civil Aeronautics Administration. This growing interest has originated naturally from a desire to preclude explosions and fire following an accident, but has also received great impetus from the nature of developments both here and abroad in the manufacture and installation of bullet-proof and self-sealing tanks for military and naval airplanes.

Out of their experience in the manufacture of such tanks and the wider dissemination of knowledge concerning comparative developments abroad, several of the major rubber companies in this country are expending much time and money on the development of a type of fuel tank which would offer considerable resistance to rupture and considerably diminish the possibility of fire in crashes and also would be economically feasible and suitable for adoption in civil aircraft. In this connection it may be mentioned that developments of this nature have reached the stage where, after having undergone suitable testing by governmental agencies, they have been adopted for installation in military and civil aircraft, not necessarily from a crash-proof viewpoint, but rather as an acceptable type of fuel tank, although it is believed they do possess crashproof qualities in some degree. The term "crashproof" is a misnomer and as applied in the aircraft industry usually connotes a fuel tank constructed in such a manner that it offers a much higher degree of resistance to rupture and fuel leakage in impacts due to crash landings than the conventional metallic tanks of present day usage.

At stated previously, several manufacturers are concentrating on the development of a crashproof type of tank which will compare in weight with conventional metallic tanks, and the Goodyear development of this nature may be briefly described here since it is considered an acceptable type of fuel tank construction by the Civil Aeronautics Administration, without consideration to crashproof qualities regarding which there exist no civil air regulations at present. The total wall thickness is .154 in. and weighs .98 lb. sq. ft. as compared to .56 lb. sq. ft. for .040 aluminum sheet construction. The tank, baffles and shell are built up of uncured stock and cured integrally, the baffles being made of fibreboard anchored to the shell with a cured bond. The necessary tank fitting attachments are built integrally into the tank by means of molded chemigum. Tanks of this construction have been dropped through distances of 40 ft. without rupture.

The cell type of fuel tank developed by the Glenn L. Martin Co. and now manufactured by the U. S. Rubber Co., though originally conceived for the purpose of providing a fuel container which would be lighter and easier to replace, remove or repair than the conventional metal tank, has also some merit with regard to diminishing the fire hazard in a crash. The cell material is a neoprene impregnated and calendered fabric .025 in. thick, sections of which are cemented and stitched together to form a tough and flexible fuel container in which all the stresses due to the weight of the gasoline are taken by the surrounding tank compartment structure. Such a cell tends to reduce the spillage of gasoline over wide areas if the tank is punctured in a crash.

The Henderson crashproof tank manufactured in Great Britain is used as standard equipment on the Miles Master Trainer. The wall of this tank is

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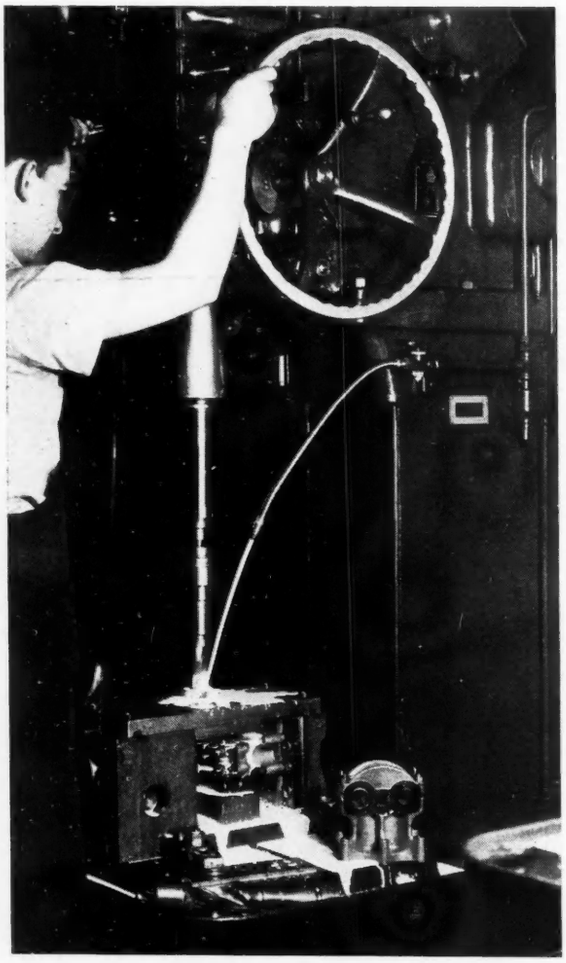
Sterling Engine



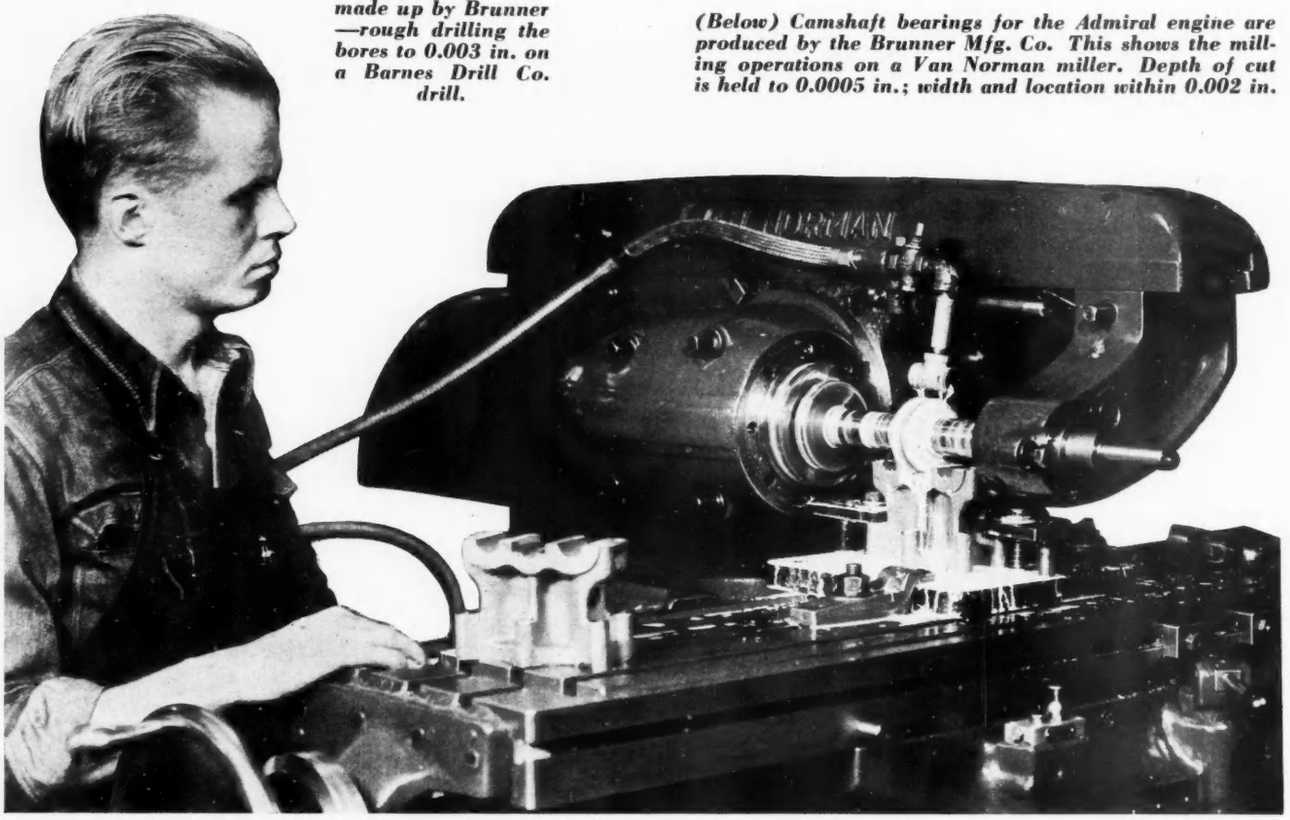
(Above) Camshaft bearing assembly made up by Brunner —rough drilling the bores to 0.003 in. on a Barnes Drill Co. drill.

SPURRED by the ever-increasing demands of the national defense program, the Sterling Engine Co. has almost tripled its working force and has practically doubled its productive floor space by the construction of a $500,000 addition to its plant. Sterling now is supplying its gasoline marine engines to the navies of the U. S. A. and Great Britain for powering fast torpedo boats, for airplane rescue boats, U. S. Army rescue boats and for other craft including a fleet of U. S. Coast Guard picket and patrol boats. Also supplying engines as prime movers for emergency electric powerplants, fire pump, water supply pumps, railway gun mounts, etc.

The engines produced for this purpose include—the new Admiral 1200 hp. supercharged engine, 800 hp. unsupercharged, the 8-cylinder 600-hp. Viking, 450-hp. 6-cylinder Viking engine, 6-cylinder 300-hp. Dolphin, 240-hp. 8-cylinder Dolphin and the 6-cylinder 225-hp. Petrel.

Stemming from a background of about 40 years of building high grade heavy-duty marine powerplants, the new Admiral gasoline engine is of 12-cylinder 60 deg. Vee type, 6⅜ in. bore x 6½ in. stroke, 2500 cu. in. displacement, rated 800 hp. at 2200 r.p.m. (standard), and 1200 hp. at 2350 r.p.m. supercharged. The weight of this engine complete with reverse gear, remote controls,

(Below) Camshaft bearings for the Admiral engine are produced by the Brunner Mfg. Co. This shows the milling operations on a Van Norman miller. Depth of cut is held to 0.0005 in.; width and location within 0.002 in.

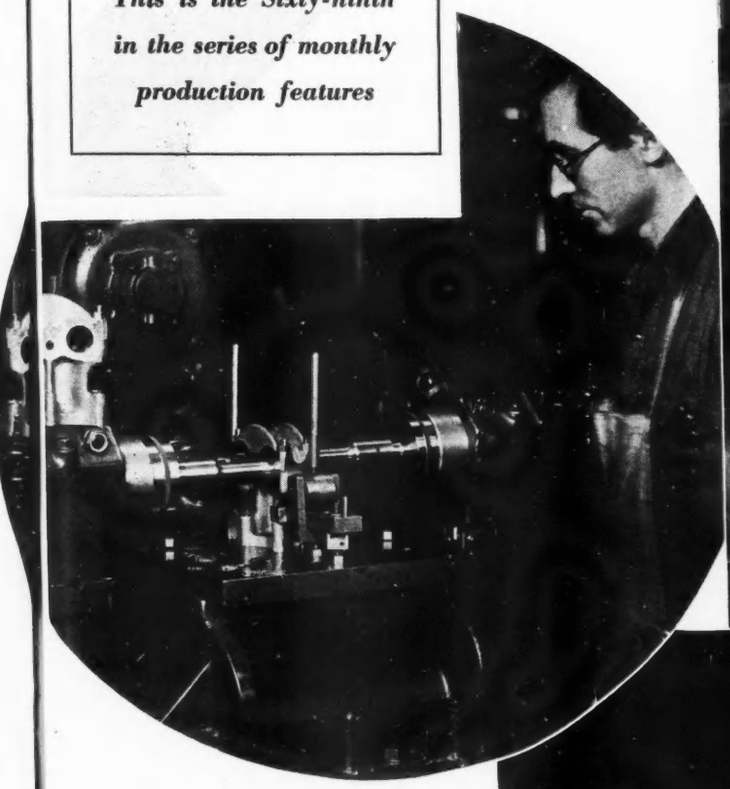


Production for War Boats

fresh water cooling system, and all accessories does not exceed 4200 lb.

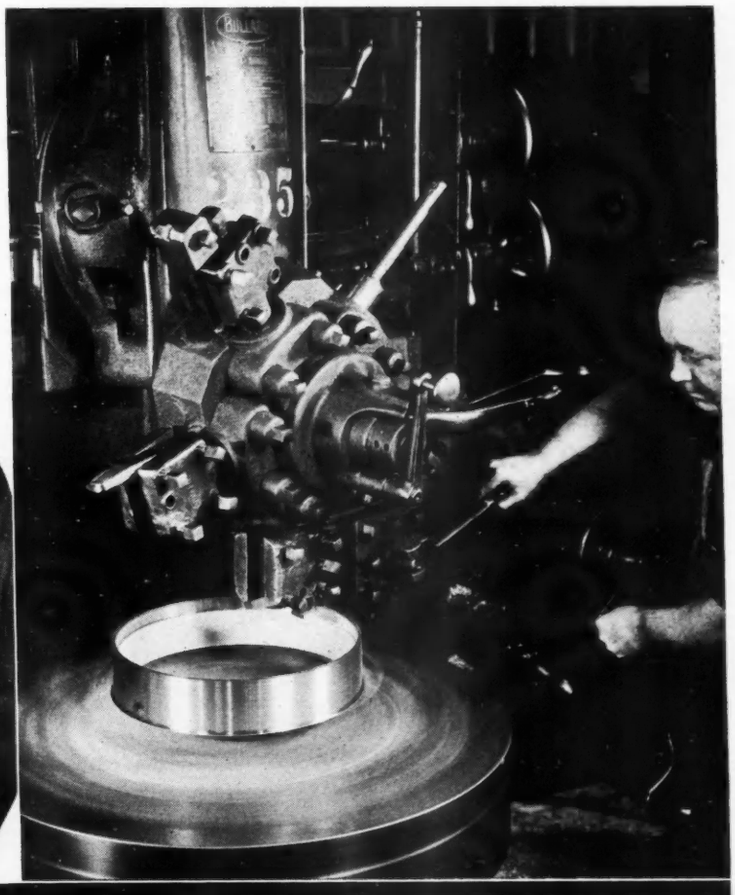
The new assembly building is intended for housing the assembly and testing of Admiral engines. According to the specifications, it is a three-story and basement steel frame structure, with brick

This is the Sixty-ninth in the series of monthly production features



Double-end Ex-Cell-O precision boring machine is used by Brunner for the finish-boring of camshaft bearing pedestals. Diameter is held to 0.001; location to 0.0005 in.

Bullard V-T-L machines are employed for a variety of turning, boring, and facing operations at Sterling.



(Right) Quality control. This is one of the many inspection procedures at Sterling, in this case the checking of incoming crankshafts for the Admiral engine.

Cincinnati jig borer at General Electric Co., boring the impeller shaft bearing hole in the supercharger rear compressor casing. The inside diameter is held to plus or minus 0.0005 in.

and tile walls, and reinforced concrete floors. A connecting bridge across an adjoining street links the old building with the new.

The third floor of the building is used for the storage of finished parts and for subassembly. The second floor is laid out for two Admiral final assembly lines. Full protection against dust and dirt is afforded in this department by provision for the circulation of fresh air fed in through filtered ducts. The windows on this floor are fixed.

The first floor houses 10 individual test cells, operated from outside control chambers, suitably sound-proofed. These test cells have been designed along the lines of the most advanced practice in the aircraft field. Among the major items of equipment in the final testing department is a battery of 11 Taylor Hi-Eff hydraulic dynamometers of high speed, high torque type, familiar in the automotive industry.

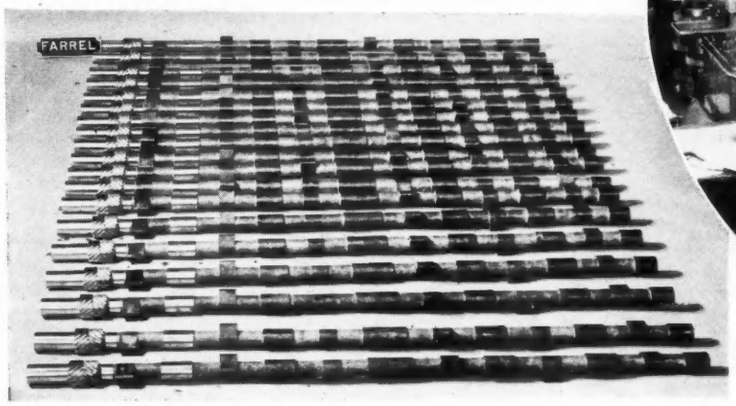
The first floor also accommodates facilities for painting and shipping. Fluorescent light-

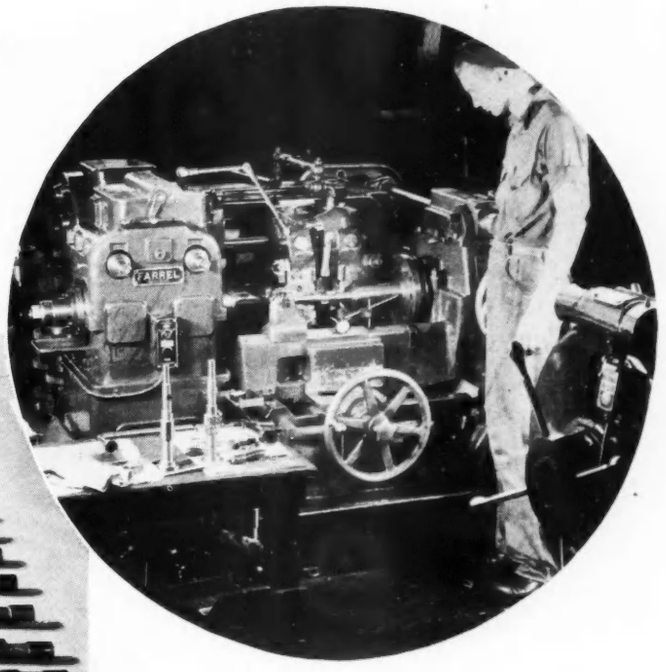
(Lower left) One of a battery of new 5-ft. Carlton radial drills, used for a variety of drilling and tapping operations on the Admiral engine. This shows some drilling and tapping operations on a cylinder head.

(Below) Jarvis flexible burring machine used at General Electric Co., for the finishing of supercharger compressor casing assembly.

(Right) Camshaft idler pinion is produced by Farrel-Birmingham. Farrel-Sykes gear generator is cutting fifteen 10-pitch herringbone gear teeth on the shaft blank. Tooth spacing and thickness are held within 0.001 in. Angular relation of flange holes to the index gear tooth is held within ¼ of a degree.

(Below) Herringbone gear on the camshaft, mating with the camshaft idler pinion, are cut by Farrel-Birmingham on the machine shown in the circle. Tooth spacing and thickness are held within 0.001 in. Angular relation of the index gear tooth with the cams is held to within ¼ of a degree.

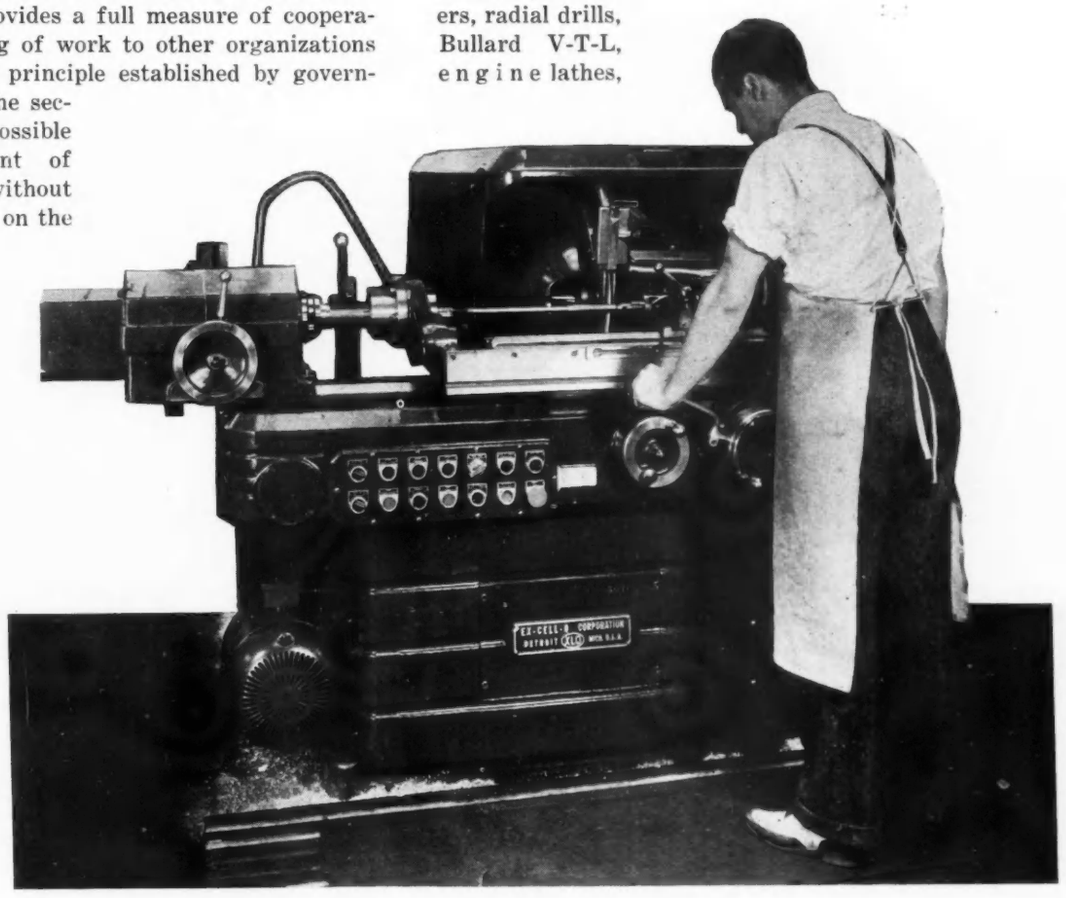




ing is installed throughout the first and second floors.

Due to the unprecedented pressure on its available manufacturing facilities, Sterling has found it desirable to draw upon the facilities of a number of outstanding producers to serve as sub-contractors. This activity has great importance for several reasons. In the first place, it provides a full measure of cooperation in the spreading of work to other organizations in keeping with the principle established by government agencies. In the second place it made possible immediate fulfillment of the Navy contracts without the delays attendant on the development of new resources; and finally, it avoided delays in production incident to the delivery of new machine tool equipment which would otherwise be necessary.

In keeping with the character of the manufacturing operation, the equipment in the plant consists primarily of precision type, heavy duty general purpose machinery, such as large milling machines, surface grinders, radial drills, Bullard V-T-L, engine lathes,



Admiral engine through studs have precision ground threaded ends. This #33 Ex-Cell-O thread grinder is used by the Aircraft Screw products Co., for producing the "Aero - Thread" stud ends.

Magnaflux inspection of parts in the Sterling plant.

modern airplane engines. This philosophy extends not only to the metal cutting operations but to assembly methods and block testing. Needless to say, quality control is a vital part of the program, with painstaking checks on every step in the manufacturing process. In addition to the usual precision inspection devices and instrumentation, Sterling uses the Magnaflux method for inspecting all highly stressed ferrous parts to assure freedom from

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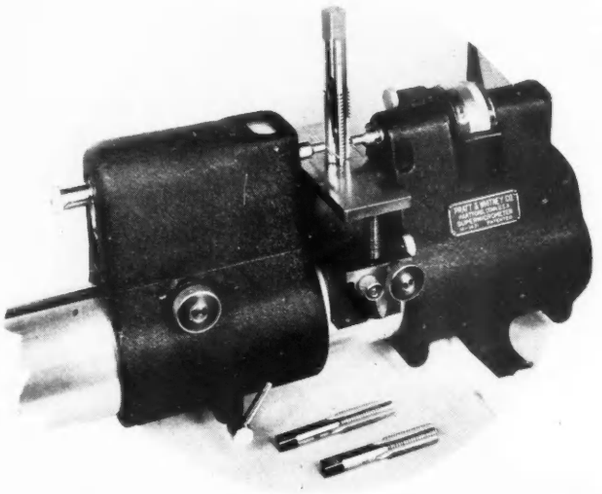
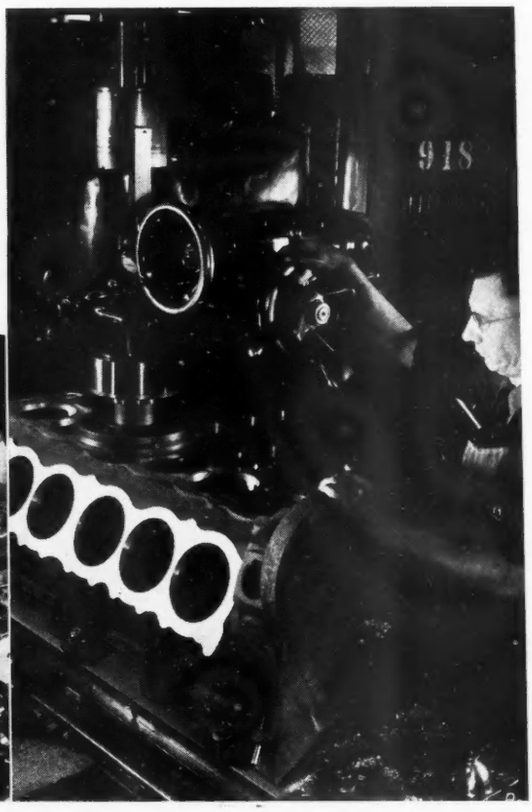
(Circle) Taps for Sterling Aero-Thread crankcase tapping operations are supplied by Aircraft Screw Products. This Pratt & Whitney Super-Micrometer is used for checking taps, using the three-wire system.



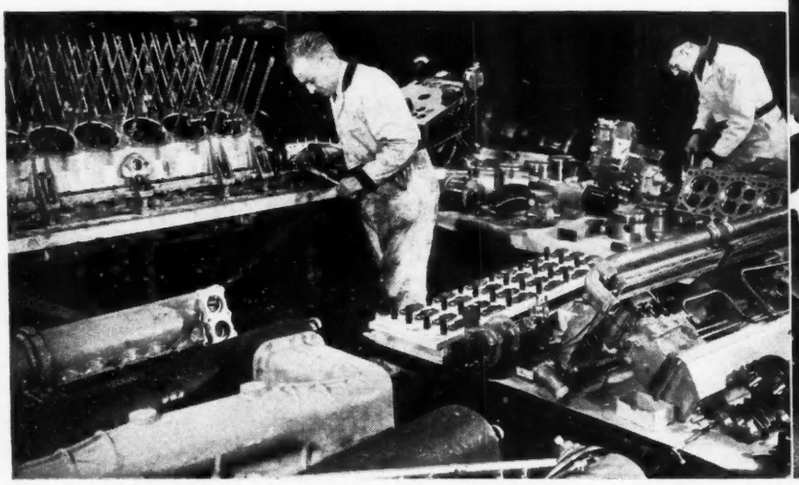
etc. Such equipment, when provided with suitable jigs and fixtures, and handled by skilled mechanics is capable of turning out work of the highest quality consistent with the speed of the operation.

Manufacturing methods, standards of quality, and exacting tolerances on important dimensions follow the practice established in the production of

(Lower right) Finish-milling of cylinder block pads on the Admiral crankcase is done on a precision type Reed Prentice miller. View taken in the Sterling plant.



(Below) It takes something over 10,000 items to make up the assembly of the Admiral engine. Here are the components arranged for final assembly.



New Riveting Technique

facilitates work in difficult places and "blind" sections

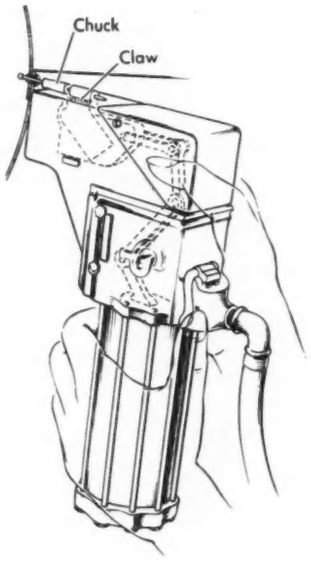
THE use of tubular rivets in place of solid metal ones is not a new idea, but their use has been restricted in the past by difficulties encountered in their production and use. With the co-operation of United-Carr Fastener Company of Canada Limited, a new type of tubular rivet has been developed at the Fort William, Ontario, plant of Canadian Car and Foundry. Stamped from strip stock in an automatic eyelet machine, the rivet is ready for application after it is slipped on a commercial nail necked down under the head.

A standard pneumatic squeezer redesigned with a chuck and claw is used in the setting operation. First, the rivet unit is slipped into the hole from the front side of the section to be riveted. Then the shank of the nail is gripped in the claw of the squeezer while the chuck holds the lip of the rivet against the face of the material. With a slight application of air pressure the gun draws the nail outwardly. Finally, when the rivet has been compressed a predetermined amount, the nail breaks apart at the constriction, the head drops off inside, and the shank is retained in the claw of the squeezer.

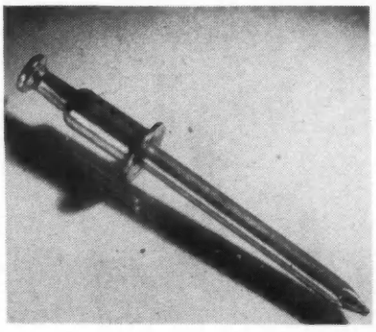
Primarily, the rivet is used for "blind" sections of the wing and fuselage where it is almost impossible for a workman to apply a dolly to "buck up" from the inside while a riveter works from the outside. In some cases, such sections are fastened together with self-tapping screws; in others, where riveting is employed, workmen are forced to grope in the dark with long-handled dollies. With this new rivet, however, it is possible to do a good job regardless of the size, shape, location, or complexity of the section.

Two men, working as a team at a rate purported to be five to six times the average speed for conventional riveting, are able to set as many as 20 rivets per minute. One man coats the hole with barium chromate and places the rivet while the other operates the squeezer.

Other advantages are claimed for this process. No experienced help is required; riveting action is positive with few rejections; and uniform work hardening is assured. At the Fort William plant, Monel, duralumin, and carbon steel are used in rivet production. Monel is usually specified for stressed parts where resistance to corrosion is essential and where tensile strength approximating that of the metals being joined is desirable. Monel rivets, even after all rivet-forming operations and the subsequent "pulling," retain a high degree of ductility. Formed rivets boiled for one hour in a solution of 0.10 per cent mercurous nitrate in 0.10 N nitric acid at The International Nickel Company's research laboratory revealed no cracks when inspected under a high-power miscroscope.



Hollow rivets are fastened or "pulled" by this pneumatic squeezer. While the chuck bearing against the lip of the rivet holds it firmly in place, the claw pulls the nail, thus setting the rivet securely.

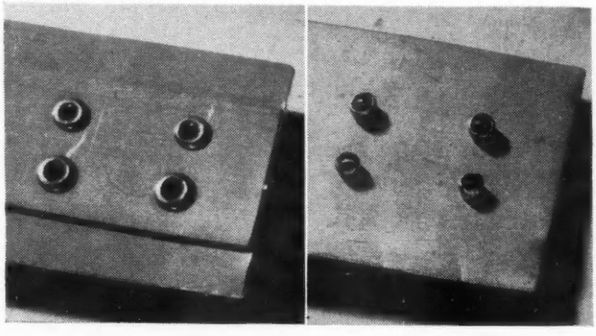


Rivets, supplied in many sizes and materials, are slipped over ordinary carbon steel nails which are necked down near the head so that they will break off when the rivet has been expanded sufficiently.

Furthermore, the use of these rivets has speeded up production of fabric-covered training ships. By incorporating fabric-retaining strips it is possible to rivet sections which were formerly sewed together with needle and thread. In cases where the rivets are used on exposed sections of the wing, for instance, a special plastic compound is worked into the rivets to cut down wind resistance.

Low cost of production is still another advantage. Rivets can be stamped out of strip stock at the rate of 110 units per minute. Furnished in forty sizes of many lengths, the rivets range in diameter from 3/32 to 3/16 in., and in wall thickness from 0.018 to 0.027 in. In fabricating operations little metal is wasted since each strip is run through the machine three times to prevent staggered cuts.

Reports from the field show that this type of rivet is admirably adapted to the repair of bullet holes and other combat damage. Much time is saved since patches can be applied from the exterior; equipment needs can be held to a minimum; and experienced workmen can be released for repair work calling for greater skill.



Front and rear views of sections fastened together with tubular rivets show the neat appearance of the exterior and the upset portion formed by the action of the rivet squeezer.

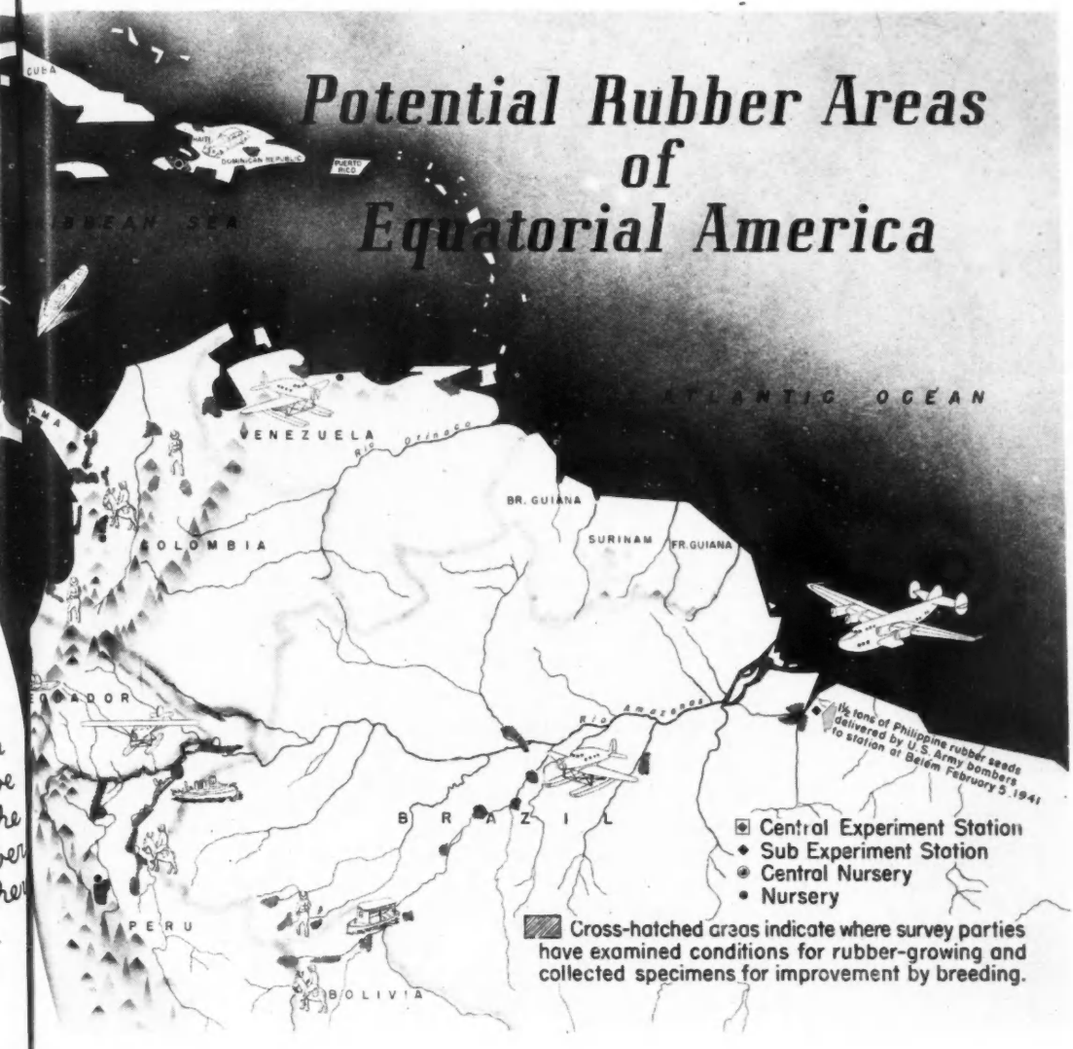
Looking to Latin America for Rubber

By E. L. Warner, Jr.

Natives are tapping for "jungle rubber." There are millions of these wild rubber trees in Brazil, but their yield is low. Their inaccessibility in the jungles and lack of labor accentuate the problem. Latex vessels are located in the soft bark and follow a slight spiral from left to right. To cut the maximum number of vessels tapping cut is made on a spiral.

RUBBER, the native Amazon plant which was transferred to the rich soil of Malaya and the Dutch East Indies before it flourished commercially, and then became such an integral part of the automobile industry that its lack threatens to cripple the nation's motor transportation, is on the verge of a comeback in the Western Hemisphere. This is no overnight development that will provide sorely needed rubber for the war program or tires next year. It is a long-range program that will take eight or ten years to achieve any substantial results. Unless all present indications fail, it will make the United States independent of sources of supply that are 12,000 miles from our shores. Instead of bringing the rubber across vast stretches of ocean in which the cargoes are vulnerable to hostile warships and aircraft, the voyage would be immeasurably shortened. Ships only have to travel 1000 to 3000 miles between Latin American ports and the U. S. Gulf Coast.

The cause of hemispherical solidarity also will be greatly advanced if the plans for rubber growing in Central and South America are successful. Rubber would provide Latin America with a raw material that is essential to the industry of United States and thus would increase commerce between the United States and its neighbors to the South. Trade is not



Ford, Goodyear and Firestone Undertook Years of Struggle to Establish Plantations in Western Hemisphere. Department of Agriculture Also Has Started Extensive Experimental Program

a one-way proposition so the reciprocal relations between this country and Latin America would be bolstered considerably by this economic application of the "good neighbor" policy to rubber.

The story is well known of how Sir Henry Wickham smuggled the seeds of the "Hevea Brasiliensis," or wild rubber tree, from the Amazon Valley to England and thence to Malaya in 1876. In 1890 two-thirds of the world's rubber still was derived from Brazil, and in the next 10 years 145 United States companies were formed with capital of nearly $75 million to start rubber plantations in Central America and Mexico. Although more than 32 million trees were planted, practically all the companies failed due to plant blight, competition of cheaper rubber from the Far East, and other circumstances.

Following the first World War, Great Britain inaugurated the Stevenson Plan which restricted the export of crude rubber from British possessions and was designed to restore prices to a high level. In 1923, the Departments of Agriculture and Commerce started rubber developmental work in Latin America with a $500,000 grant from Congress. Experiments were carried on in Haiti and Panama, but these eventually died due to lack of appropriations. Work continued at Department of Agriculture experimental stations at Beltsville, Md., Cocoanut Grove, Fla., and Bard, Cal., until 1931, when the depression forced suspension of the activity due to lack of funds.

However, the Ford Motor Co. started its own Brazilian plantation in 1927 with the object of developing a supply of rubber for tires for its cars that would be independent of the British-controlled Malayan rubber market. A 2,500,000-acre concession, known as Fordlandia, was obtained from the Brazilian government in 1927, located on the Tapajoz River 150 miles from

Fully-matured trees on the Firestone plantation in Liberia, Africa, from where millions of seeds are being shipped to many of the rubber experimental stations that have been started in Central and South American countries by the U. S. Dept. of Agriculture. These trees are 25 years old and are yielding as much latex now as they did at the age of 10 years.

Dr. E. W. Brandes (left), tropical agriculture expert of the Dept. of Agriculture, and Harvey S. Firestone, Jr., are examining a shipment of seeds from the Firestone Liberia plantation.

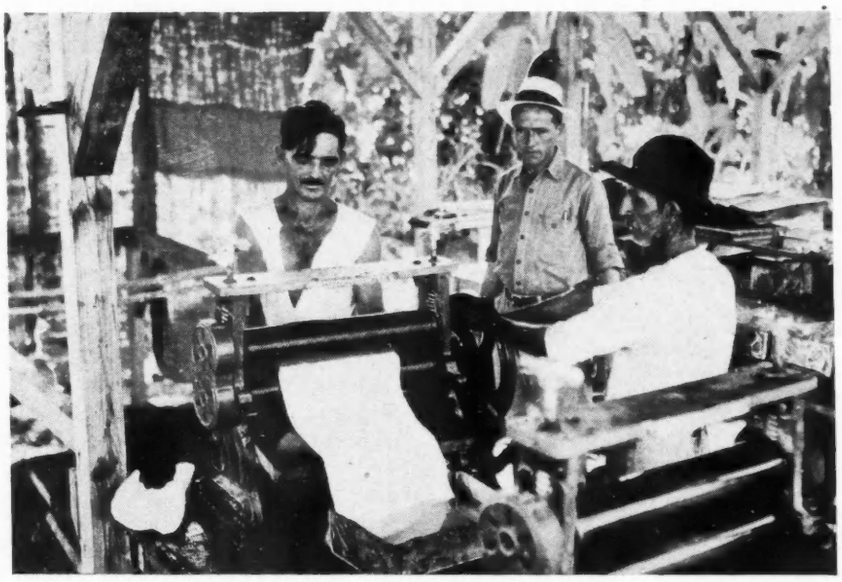
the point where it empties into the Amazon and approximately 700 miles from Para, the rubber port at the mouth of the Amazon.

In 1934 the Goodyear Rubber Plantation Co. acquired 2800 acres in the Canal Zone, adjacent to Gatun Lake, for rubber experimental work. This was called the All-Weather Estate. In 1935 an additional 1000 acres of abandoned banana land were acquired by Goodyear at Cairo, Costo Rica, about 100 miles inland from Port Limon on the Caribbean. Recently another 1500 acres were added to this development, which is known as the Speedway Estate. Firestone Tire & Rubber Co., which had pioneered in the development of a plantation in Liberia, Africa, in 1924, began a 5000-acre experimental station at Telo, Honduras, in July, 1940.

Early in the defense program the Government realized this country's sources of rubber in the Far East might be jeopardized through a spread of the conflict by the Axis powers. Congress included an appropriation for $500,000 in the second deficiency bill passed June 22, 1940, "to enable the Secretary of Agriculture to conduct investigations directed toward the development of rubber production in the Western Hemisphere, including production, breeding, and disease research; surveys of potential rubber-producing areas; establishment and operation of experiment and demonstration stations in suitable locations; acquisition of land for such purposes; construction of necessary buildings . . ."

By July the Bureau of Plant Industry had begun to carry out a three-year program of cooperative action with 13 Latin American nations. Scores of nurseries have been established, eight to ten million trees have been planted and Dept. of Agriculture field representatives have instructed officials and natives of the various nations in the details of rubber tree cultivation. Survey parties visited various sections of the Latin American nations which are suitable to rubber growing and selected test-planting sites for experi-

From its Pathfinder Estate at Mindanao Island, Philippines, Goodyear obtained rubber tree stumps to be used in producing high-yielding trees on its plantations in Central America.



Making rubber sheet on a hand milling machine at a Goodyear plantation. Afterwards it will be dried in a smokehouse preparatory for shipment.

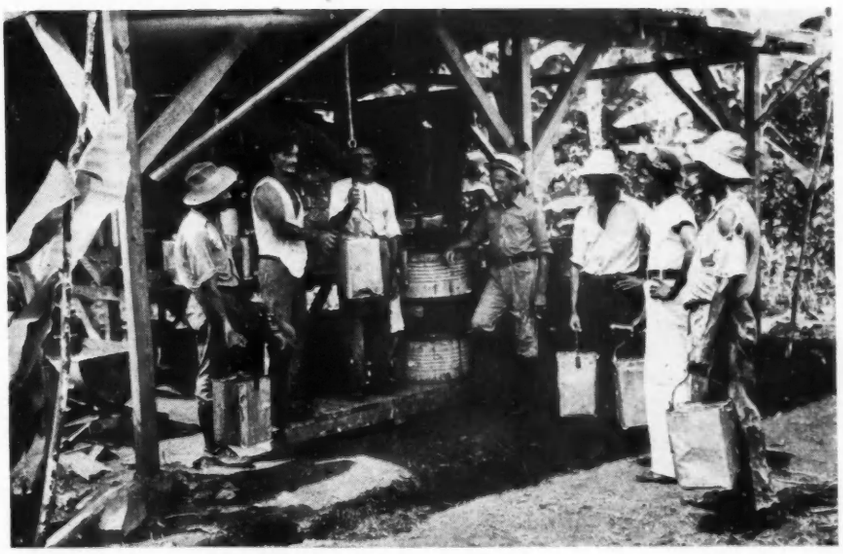
mentation. A central experimental station was set up at Turrialba, Costa Rica, while subsidiary stations were established in Honduras and Haiti. Countries in which cooperative rubber growing ventures now are under way are Brazil, Haiti, Peru, Ecuador, Colombia, Venezuela, Panama, Honduras, Mexico, Guatemala and Nicaragua. The governments of Brazil, Peru and Mexico have appropriated money for these experiments, while the United States has granted a $5 million loan to Haiti for agricultural development, including rubber.

Para (plantation) rubber grows best in the tropical region 10 deg. north and south of the Equator at altitudes up to 1000 ft., although it is successfully cultivated as much as 16 deg. from the Equator, as in Haiti and Mexico. It requires an annual rainfall of 80 to 125 in. and afternoon precipitation is necessary because tapping of the trees must be done in the morning before the day's heat stops the latex from flowing. Trees are first tapped when they have attained an 18-in. circumference 3 ft. from the ground, at which time they are four to six years old. The trees reach their fullest productivity about their tenth year. It takes one to two years to prepare the land, plant seeds, grow nursery seedlings, bud and transplant, and from four to five years more before tapping may commence.

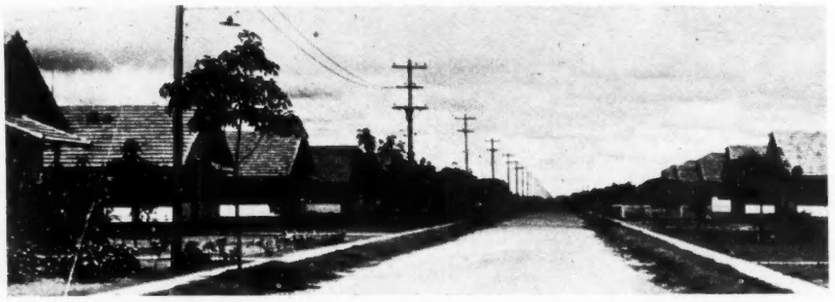
Biggest drawback to the development of the plantation rubber industry in the Western Hemisphere has been the South American leaf blight, a fungus that attacks the leaves. Wild rubber trees in mixed jungle growth are only slightly affected by this blight, but the closely spaced nursery and plantation trees, which are planted 100 or more to the acre, are especially susceptible to attack. Only in the last couple of years have plant experts from the rubber companies and the Department of Agriculture become satisfied with disease-resistant strains of the "Hevea Brasiliensis" which they have developed. This has been achieved by cross-pollination of seeds derived from trees that have survived in the disease-ridden areas of Brazil, Panama and Costa Rica, and then selective breeding of these plants. Goodyear acquired a former banana plantation in Costa Rica where the United Fruit Co. had experimented with rubber growing 20 years previously. The leaf blight had killed many of the trees, but a few hardy survivors have been used as a source of disease-resistant seeds.

In introducing disease-resistant strains into new areas, the Department of Agriculture first brings the imported plants to the quarantine greenhouse at Washington, where they are observed and tested for the leaf blight. After passing this test, the plants are shipped to Haiti, Honduras, or other experimental nurseries in Latin America, which have not yet suffered from the leaf fungus. The Fordlandia plantation also has developed many disease-resistant "clones," or plant families, after years of experiment by trial and error methods.

After developing disease-resistant plants, the next step is to cross them with high-yielding strains from the Far East. In Malaya the rubber yield was about 450 lb. to the acre. Through selective breeding, plantations on Sumatra have been developed that yield as high as 1000 lb. per acre. Budwood, which consists of 3-ft. lengths of parent tree branches each contain-



Tappers arriving at factory on Goodyear plantation for weighing of latex collected by them.



This might be a street scene in a midwestern town, with its paved roads, cement walks, comfortable homes, electric lights and telephones. It is Belterra, buried deep in the jungle of Brazil. Ford's model villages also include hospitals, schools, churches, radio stations and power houses.

ing 10 to 30 buds, and budded stumps, which are seedling trees to which living buds have been grafted, have been shipped from high yielding areas in Sumatra, Liberia and the Philippines to experimental nurseries in South and Central America. The budded stumps are planted upon arrival while the budwood is grafted on to nursery-grown seedlings eight months to one year old. The importance of careful transportation of seeds and budwood between nurseries is emphasized by the fact that U. S. Army bombers were used to carry these shipments between Central America and Brazil early in 1941.

Labor is another important factor in the growth of rubber. Approximately one worker is required for every six acres of plantation-grown rubber in the East Indies. Thus a 30,000-acre development would require about 5000 workers. A worker can tap 300 to 400 trees per day, depending upon the terrain. Labor is cheap and plentiful in the Far East, getting about 35 cents per day. But in South and Central America labor is scarcer and better paid. One rubber company had to curtail its experimental operations in Panama because the demand for labor on defense work in the Canal Zone sent the price above the $1 per day rate which the company could afford to pay for such work.

Development of rubber growing in Latin America undoubtedly will be on a sounder basis if the natives are taught to grow the rubber on their own land and alternate it with subsistence crops such as rice, casava, beans and cacao. This makes the natives self-sufficient. They can grow rubber as a cash crop, planting from three to 25 acres in rubber, depending upon the size of the family. Approximately 50 per cent of the Far East rubber is grown in native gardens or "kabuns," as they are called in Malaya. To assure a high quality rubber, it is necessary that United States corporations and Latin American governments set up plantations of their own in the tropical areas in order that the natives can acquire by precept and example the needed skills in conducting their own rubber-growing enterprises. Haphazard planting and cultivation would make them easy prey to the leaf blight. The natives must be taught the proper time and method for tapping the trees. Small factories for processing the latex, smoking it and rolling it into sheets also must be established so that the natives can market their rubber easily.

This cluster of 6 to 9-year-old trees at Fordlandia are ready to tap for the first time.

Here is a "Budwood Garden" on a Ford plantation for growing young saplings from seeds and then using them for grafting buds from high-yield "clones."

Ford's rubber development in the Amazon Valley, which to date represents an investment of more than $9 million, has been hampered by the leaf blight and a scarcity of labor. The 2,500,000-acre Fordlandia plantation was cleared in 1927 and 2,000,000 seeds gathered from wild rubber trees in many parts of the Amazon Valley were planted. But the leaf fungus proved decimating and only 750,000 of the trees have

(*Turn to page* 75, *please*)

Mr. Sikorsky is shown flying his helicopter with its latest improvements. Longitudinal and lateral control is obtained by changing the main lifting rotor inclination. Only one rotor is necessary at the rear.

Sikorsky Helicopter

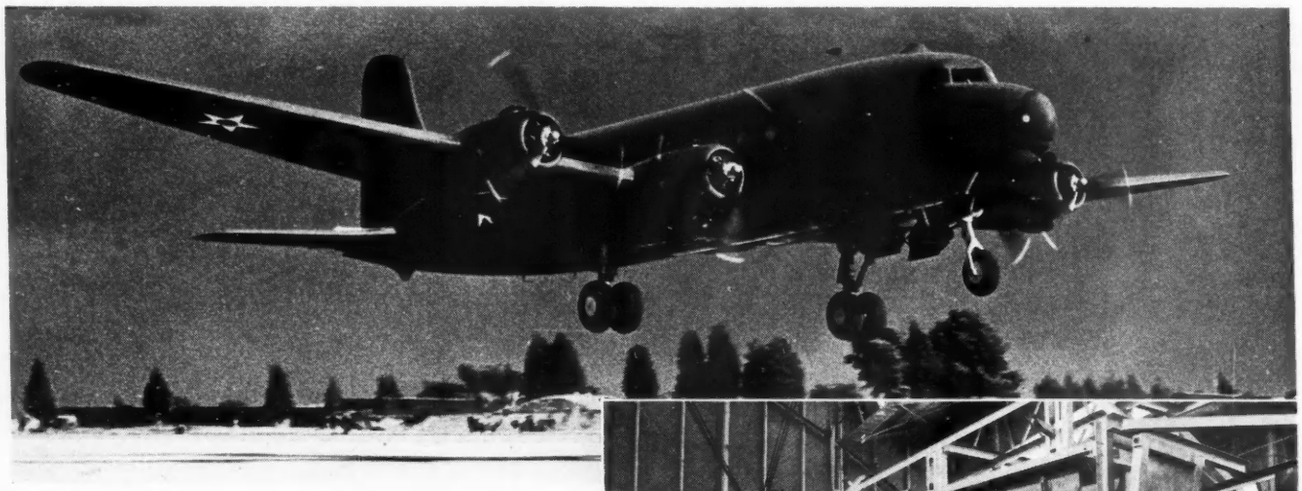
IGOR I. SIKORSKY'S VS-300 helicopter in its latest form, which is illustrated here, incorporates the use of sectional, azimuthal change of the main lifting rotor pitch along two approximately perpendicular axes so as to provide longitudinal as well as lateral control by the inclination thus produced in the main lifting rotor. Counteracting the torque of the main lifting rotor, as well as directional control, is obtained by the auxiliary rotor mounted on the horizontal shaft near the end of the fuselage.

This Sikorsky helicopter has a three-bladed main rotor of 14 ft. radius, and a two-bladed torque-compensating propeller of 46 in. radius. In hovering flight, the main rotor turns at about 260 r.p.m. and the tail propeller about 1300 r.p.m. A free-wheeling unit operates between the engine and the rotor drives, so that the blades may continue to turn in autorotation in the event of engine failure. Power is supplied by a Franklin 4AC-199, 90 hp. engine through a multiple Vee-belt drive and a set of bevel gears.

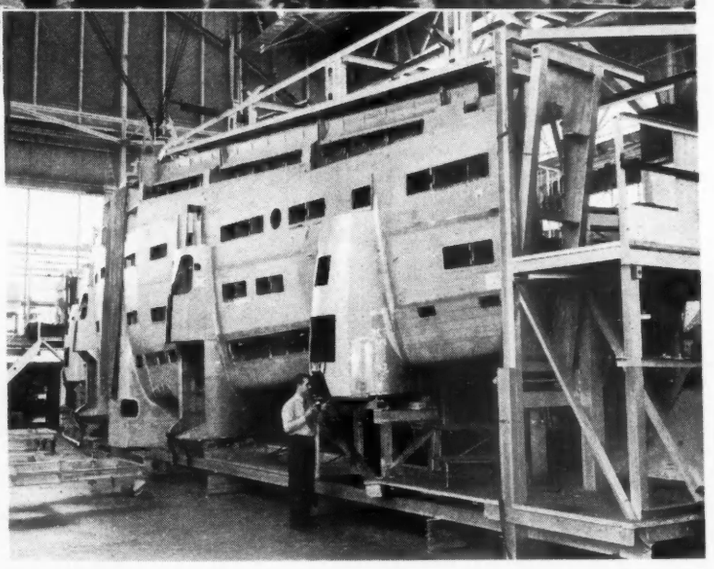
In developing this basic type of helicopter with one main lifting rotor combined with an auxiliary rotor for compensating the torque, two other arrangements other than the one described above were investigated for longitudinal and lateral control. Originally, in addition to the compensating torque rotor at the rear of the fuselage, two auxiliary rotors on vertical shafts were mounted on supporting structures extending from each side at the rear of the fuselage. Simultaneous change of the pitch of both rotors supplied the means for longitudinal control, while changing them differentially provided lateral control. In 1941 a VS-300 of this design, flown by Mr. Sikorsky, broke the previous international record for helicopter endurance by remaining in the air 1 hr., 32 min. and 26.1 sec.

The third design had one auxiliary rotor on a vertical shaft near the end of the fuselage. The change of pitch in this case provided the means for longitudinal control only, while the sectional change of the pitch of the main lifting rotor provided means for lateral control.

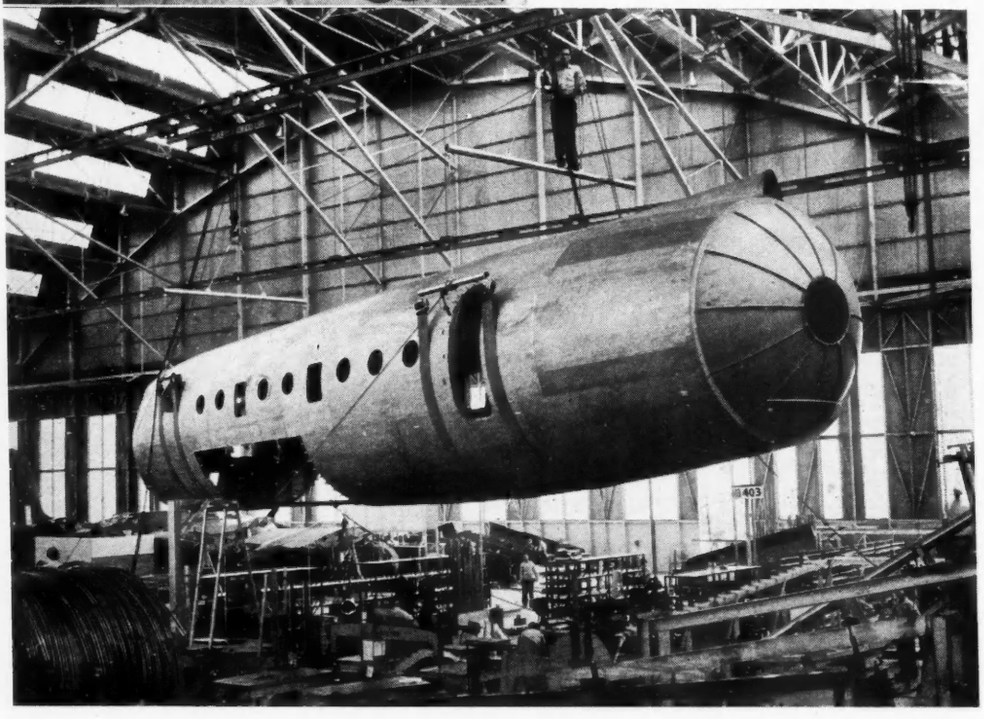
Satisfactory results were obtained with the three control arrangements, but the one adopted is believed to offer also the advantage of lightest structural weight and of greatest compactness. Mr. Sikorsky, designer of Pan-American Clippers for the Vought-Sikorsky Aircraft Division of the United Aircraft Corp., states that experimental flights now indicate the fundamental problems of the single-main-rotor helicopter have been solved successfully.



(Above) This view shows the dual wheel construction of the C-54 landing gear.



(Left) Douglas craftsmen installing interior equipment in the fuselage.



(Above) Wing center section placed in special jig for finishing touches and installation of such equipment as hydraulic lines, fuel lines and controls.

(Left) Fuselage outer section of the first C-54 being removed from one point in the assembly line to another.

Douglas C-54, the Nation's

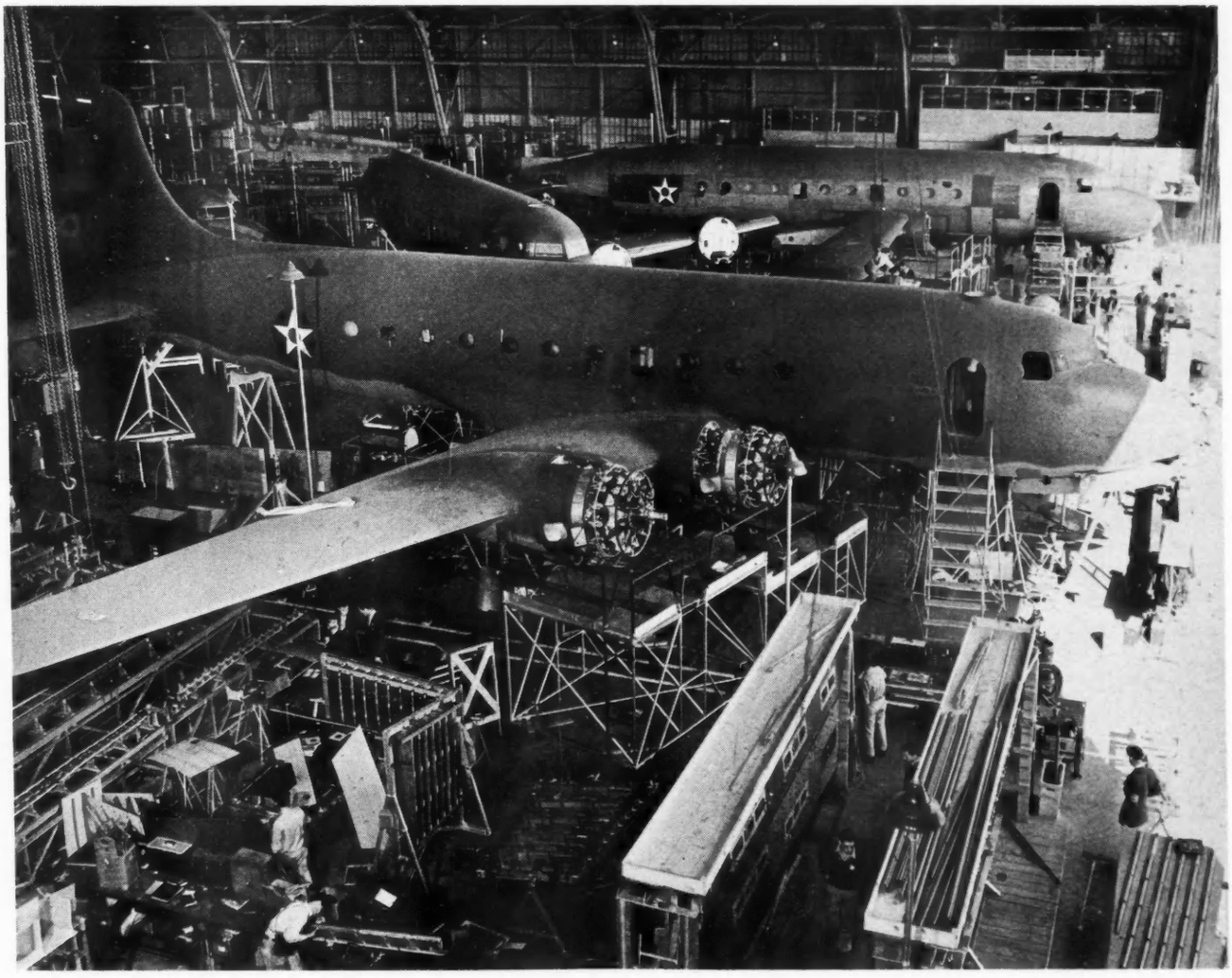
Largest Army Transport

THE Douglas C-54, America's largest Army transport, is a commercial plane, improved and converted to Army transport use and is built to carry 50 armed men. Powered by four 1350-hp. Pratt & Whitney Twin Wasps, it has a fully retractable tricycle landing gear of an improved type. The main wheels are in pairs, two to an oleo strut for added safety in case of a tire blowout or brake failure on landing.

The C-54 is greatly different from its predecessor, the DC-4. It is slightly smaller and considerably faster, but as a commercial plane would also carry 42 passengers. The new C-54 is not an experiemntal model. Tooling for volume production has been finished, and even before the first test flights were scheduled, additional units were nearing completion, with still more on the assembly lines.

Conversion of the ship and its production lines from the commercial airplane to the military transport was made by the Douglas Company at an estimated loss, when the full quota of the original contract is delivered, of $2,000,000.

Overall view of a C-54 in final stages of production.



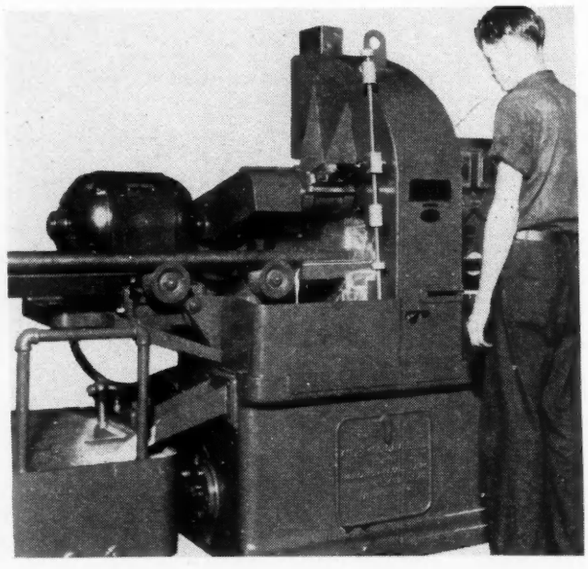
MEN and

A NEW welder for resistance welding of heavy sections and of special alloy steels has been announced by the Progressive Welder Co., Detroit. Completely self-compensating for all such variations as normal difference in metal thickness, induction and short-circuiting losses, presence of scale, etc., the welder controls automatically the current and operating cycle by means of the temperature developed at the weld. Known as the Temp-A-Trol, this new unit is said to give close control of nugget size, ductility and grain.

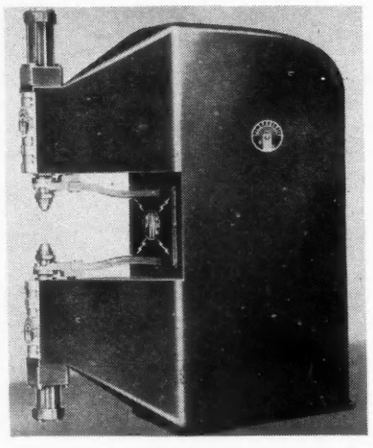
THE new No. 425 Cutalator, a wet abrasive cutting machine especially designed for fast cuts on many types of materials, has been developed by the Andrew C. Campbell Division, American Chain & Cable Co., Inc., Bridgeport, Conn. Work held in V blocks by hydraulically-operated clamps is cut by an abrasive wheel which oscillates as it rotates. A special feature of the machine is a separate caster-mounted coolant tank. Coolant picked up from the tank by the coolant pump, is sent to the work area and then returned to the tank via the machine base. The machine will cut solid stock up to 3½ in. and tubing up to 4½ in. in diameter.

TWO entirely mechanical shell-inspection gages capable of checking four or more points at one time have been introduced by Federal Products Corp., Providence, R. I. Model 205 B-84 is used in the inspection of shells for concentricity. Model 236 B-95 is adapted to checking shell diameters.

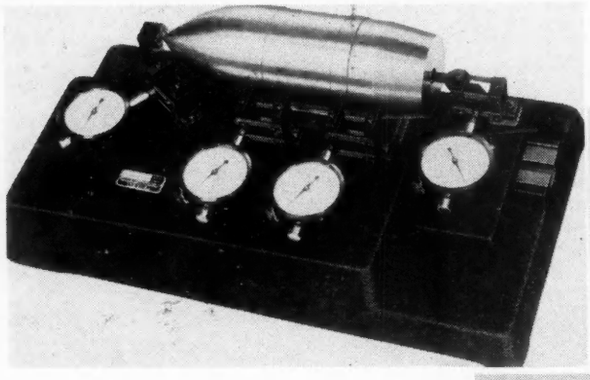
The same type of independent gage unit is used in each of the gages. Consisting of a dial indicator and anvil combination, the unit works through a pantographic spring mounting. The shell being checked rests in a V block fitted with tungsten carbide bearing points.

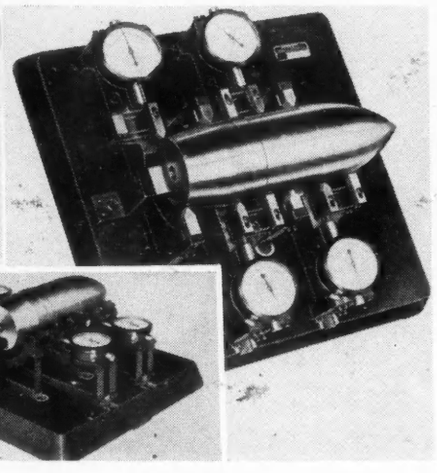


(Left) Campbell No. 425 Cutalator.



Progressive Temp-A-Trol forge welder.





These two new gages, built by Federal Products Corp., are especially constructed for checking medium caliber shells. Model 236 B-95 (right) is used to check shell diameters; Model 25 B-84 (left) is employed to check concentricity.

DEVELOPED to meet the increasing demand for power and control units for capacitor-discharge welding, the Revers-O-Charge built by the Weltronic Corp., Detroit, is especially adaptable to the welding of aluminum for aircraft. The new unit, in addition to assuring high power factor with balanced three-phase load and minimum peak kva demand, embodies numerous features said to be entirely new.

Operation of the unit is facilitated by panel-mounted meters and control knobs which are used to vary the voltage, set weld sequence, select the number of condensers, and to choose the condenser charging rate.

THE Hammond "600" Dri-N-Wet abrasive belt surfacer, built by Hammond Machinery Builders, Kalamazoo, Mich., is said to offer all the features of Hammond dry surfacers in addition to the advantages of wet operation. The floor model is equipped with a tank and pump unit which feeds the spray nozzles through a damper or spray control; it can also be furnished for direct

MACHINES

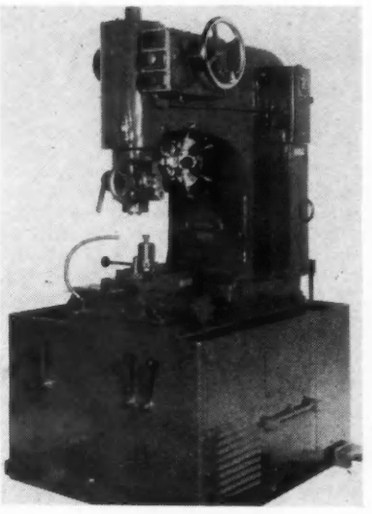
connection to a service water main. The bench model, however, is supplied only for connection to a water main.

The machines are driven by 220-440-v, three-phase, 60-cycle motors, 1½-hp. for the machine equipped with pump and tank, and 1-hp. for the machine supplied directly from a water main. The working surface is 6 by 18 in. Belt surface speeds range from 3000 to 5000 fpm.

CLEARANCES for articulated connecting rods are milled in the master rod by a semi-automatic milling machine built by the Snyder Tool & Engineering Co., Detroit. An hydraulically-operated electrically-controlled cutting cycle permits the operation of several machines simultaneously by an unskilled operator.

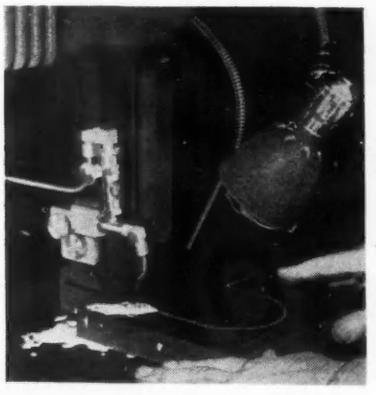
A NEW International Libby No. 4 universal ram-type turret lathe has been announced by the International Machine Tool Corporation, Libby Division, Indianapolis, Ind. Supplied with tools for both bar and chucking work, the machine will accommodate 8-, 10- and 12-in. chucks. It provides a 20-in. swing over the ways, a 22-in. turning length and a 2-in. collet chuck capacity. Three levers are used to attain the 12 spindle speeds of the all-geared headstock. The universal carriage and the turret ram slide carriage are both provided with six rates of power feed.

Powered by a 5- or 7½-hp. motor depending on the type of work, the lathe is automatically lubricated by a built-in vane pump driven from the main drive shaft. All motor controls and wiring are supplied with the machine.



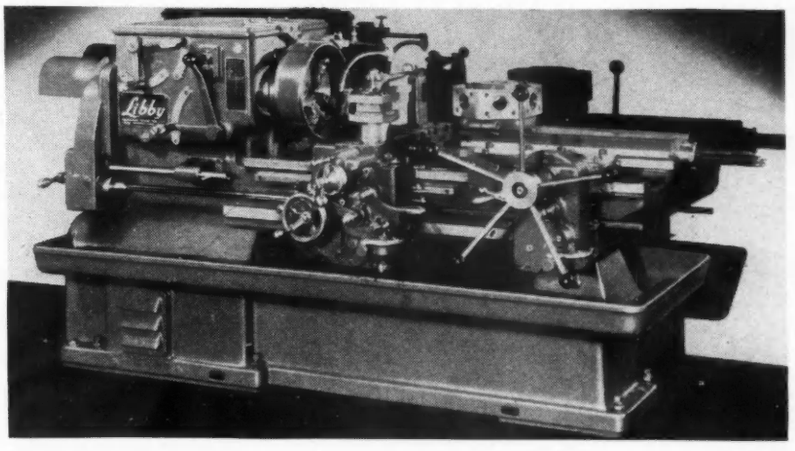
Snyder Tool & Engineering Co. has developed this machine for milling radial engine master rods.

The Hammond Machinery Builders have added this "600" Dri-N-Wet surfacer to their line of abrasive belt surfacers.

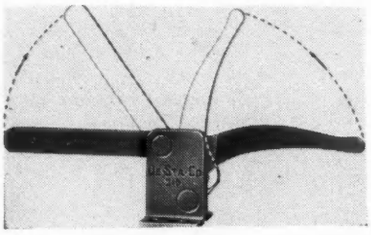


Manufactured by Continental Machines, Inc., Minneapolis, Minn., the new Doall saw lubricator provides a steady coolant flow which is said to increase cutting speed and saw life. *(Described on page 42)*

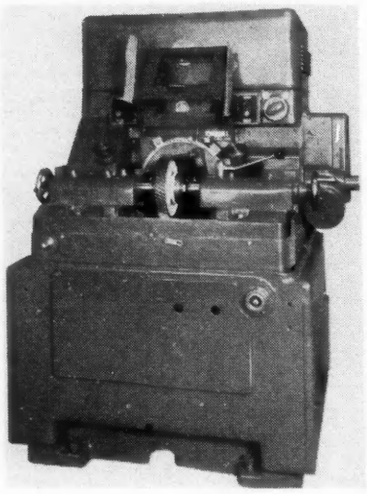
Simple in operation, the Revers-O-Charge, built by the Weltronic Corp., is especially adaptable to aluminum welding.



Designed to accommodate various types of chucks, the Libby No. 4 turret lathe features a spindle mounted on a double-row preloaded roller bearing at the front, and a single-row straight roller bearing at the rear.



A new light-duty, horizontal-style toggle clamp has been added to the De-Sta-Co line of clamps manufactured by the Detroit Stamping Co. The clamp measuring 8 11/16 in. across, 2 3/16 in. high overall, and 1⅜ by 2 2/16 in. at the base, provides a pressure ratio of 50 to 1. It ewights only 8½ oz. When in a "shut" position, both the handle and clamping bar are in a horizontal position.

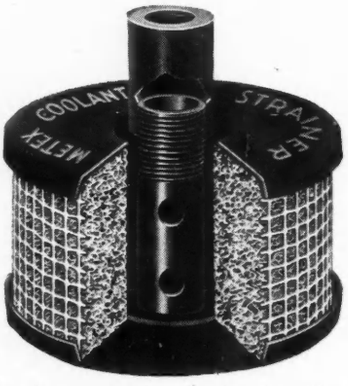


Fellows gear shapers, No. 12 (Above) and No. 24 (Below), are feature all-electric control.

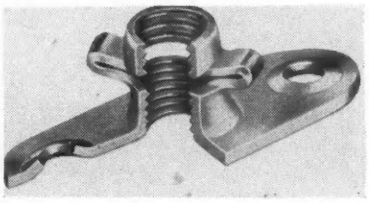
Two electrically-controlled gear finishing machines have been announced by the Fellows Gear Shaper Co., Springfield, Vt. Each machine is fitted with limit switches to control the stroke of the reciprocating tool slide and with safety switches to stop the machine automatically in case of the failure of other units. On both of these machines the work is supported on live centers held in adjustable head and tailstocks.

The No. 12 machine accommodates gears with a maximum pitch diameter of 12 in., a face width of 3 in. and a diametral pitch of 6 in. The No. 24 shaper, larger and slightly different in design, handles gears with a maximum pitch diameter of 24 in., a face width of 5 in. and a diametral pitch of 4 in.

Longer saw life, straighter cutting and finer finish are assured by the use of the new Doall saw lubricator. Coolant flow, adjusted by a feed control valve, is directed toward the point where the saw enters the work. Since Doall saw wheels are equipped with neoprene tires, any type of cutting fluid can be used to prevent the teeth from overheating when the saw is used to cut ferrous metals, and to inhibit tooth loading by softer metals such as aluminum, brass, zinc, etc. Recent tests resulted in a purported 25 per cent increase in saw life and allowed a speed increase of 10 per cent. (Illustrated on page 41).



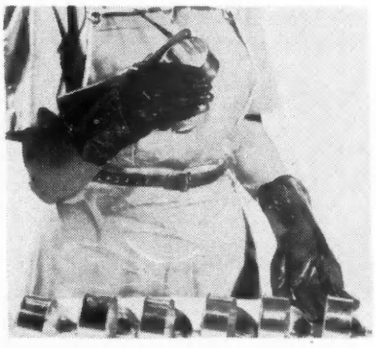
Coolant strainer made by Metal Textile Corporation.



The Boots Aircraft Nut Corp., New Canaan, Conn., is producing a new nut assembly designed to speed the application of Boots aircraft nuts where flush riveting is desired. The assemblies can be supplied for use with either 78- or 100-degree rivets.

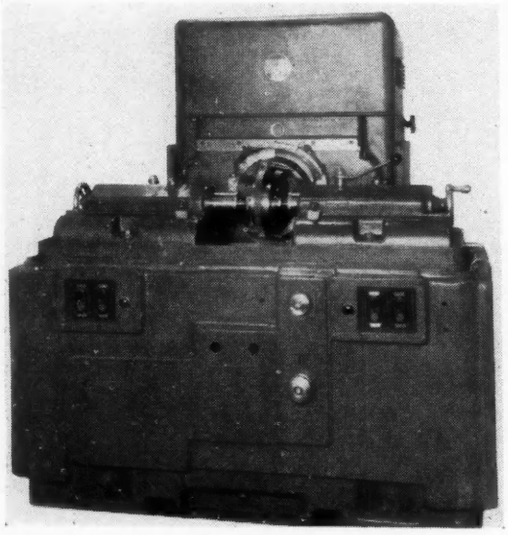
For speedy, accurate adjustment by means of a remote control, Arens Controls, Inc., Chicago, have designed a vernier and lock combination which provides push-pull movement, vernier adjustment and positive locking of the control.

A small pin set in the top of the face plate rides in the worm thread when pressure exerted by a spring in the bot-

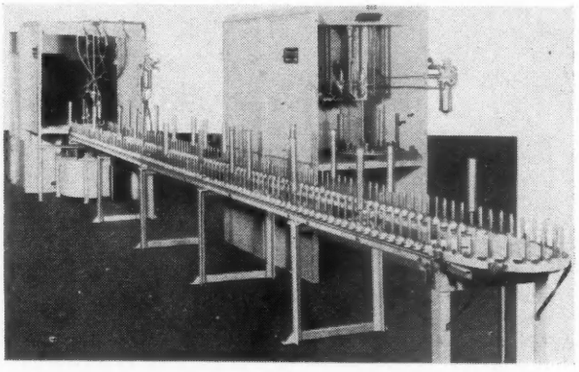


Fabricated from chemical-resistant compounds, these gloves and aprons offered by the Resistoflex Corp., Belleville, N. J., are recommended for use in industrial operations where occupational skin diseases are prevalent.

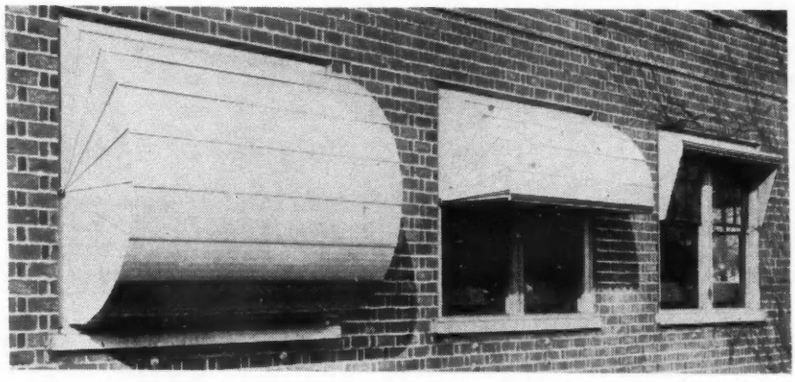
Permitting vernier adjustment of a control cable, this new Arens control head can be mounted on any type of control.

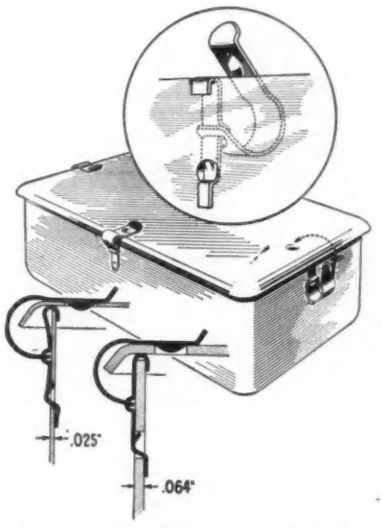


Built by the De-Vilbiss Co., Toledo, Ohio, this painting machine coats incendiary bombs on the inside and out at a maximum rate of 2000 pieces per hour. (Described on page 43)



"Meta-Fold" blackout awnings, produced by the Acklin Stamping Co., Toledo, Ohio, are fire-proof, rust-proof, and easy to operate. Constructed in segments of "galvannealed" steel, they are said to provide full use of daylight and excellent protection against flying glass and bomb splinters.





Junction box covers can be quickly and easily attached with the aid of a new two-piece Speed Clip manufactured by Tinnerman Products, Inc., Cleveland, Ohio. It can be used on boxes ranging in thickness from 0.025 in. to 0.064 in. The illustration shows clearly the method of installation and use.

tom of the plate forces the plunger, or movable threaded rod, into engagement. A slight pressure on the top of the knob releases the spring and allows the plunger to move freely. When the knob is allowed to return to its original position the plunger forces the threads into re-engagement. A twist of the knob will then permit vernier adjustment. In this manner coarse or fine adjustment of a tension-loaded control cable may be effected.

A COOLANT strainer developed by the Metal Textile Corp., Orange, N. J., is designed for installation on all machines incorporating coolant systems. Easily-installed refills are said to provide efficient cleaning for four to six weeks or better; cleaner work will permit even longer runs. The dimensions of the strainer are: diameter, 5 in.; height, 2¾ in.; overall height, 4¼ in.

DEVELOPED expressly for the prevention of occupational skin diseases, a new line of oil- and solvent-proof gloves and aprons has been announced by the Resistoflex Corp., Belleville, N. J. The products are made of a tough, flexible material said to be highly resistant to tearing and abrasion. Aprons are supplied in two styles: One is light in weight and transparent; the other, a heavy-duty type, is made from flexible material coated on both sides with a film of Resistoflex PVA material.

TO speed the painting of the exterior and interior surfaces of the component parts of M54 4-lb. incendiary bombs, the DeVilbiss Co., Toledo, Ohio, has designed a painting machine consisting of one automatic and one or two semi-automatic spraying stations. With two semi-automatic spray stations for interior painting, a machine with a 25-ft. conveyor can handle 2000 pieces per hr.; with only one semi-automatic station, a machine can paint 1000 per hr.

Aeronautical Engineering—America's Trump Card

(*Continued from page* 25)

formed of a layer of Hencorite (a patented rubber compound which acts as a sealant) bonded both externally and internally to a tinned-copper shell. The total thickness of the three layers is 3/16 in. An interesting feature of this tank is the baffling system which is so arranged that in the event of a crash the system will collapse under the impact of the pressure waves whose destructive effect will be considerably reduced thereby.

Impact Resistant Windshields

THE research work instituted in an effort to find methods and materials capable of reducing the dangerous effects of the collision of birds with aircraft was outlined in a paper read by A. L. Morse of the Civil Aeronautics Administration. After enumerating many design problems, the author concluded that the development of impact-resistant windshield materials is proceeding favorably. The completion of several test set-ups and the willingness of several companies to participate in further tests were given as indications that a satisfactory solution would soon be found.

The impact forces in such collisions are enormous, he explained, usually killing the birds and producing great damage to equipment and sometimes to personnel; in rare instances fatalities have resulted. Since one-third of the 61 accidents of this type reported since 1939 have caused penetration and shattering of the windshield, he continued, development of adequate protection means is most important.

The author discussed the newer glass-plastic combinations and noted the probable need for retractable shields. Tests of typical sections indicated that a 20-lb swan colliding with an airplane at a relative velocity of 270 mph can cause an impact force of 56 psi.

The Civil Aeronautics Administration, he announced, is arranging for a test set-up which includes: (1) An air catapult for projecting bird carcasses; (2) The forward cabin portion of an airplane with various windshield panels installed; (3) Velocity- and force-measuring equipment. All of this equipment is to be made available to other authorized agencies.

Buicks Dynamometer System

OUTSTANDING features of the engine test equipment at Buick's Melrose Park Plant, according to C. A. Chayne, are that "feed-back" equipment is used throughout and every effort has been made to reduce the lost time in the test cells to a minimum. With this equipment it is possible to operate a cell on useful work 90 per cent of the time that it is assigned to a particular engine.

Buick's power-absorption equipment employs an electric coupling of the "eddy-current" type, which permits operating the engine under load at any speed above the synchronous speed of the alternators which is 900 rpm. In case it is desired to apply load at speeds below 900 rpm, the alternators may be stopped and held stationary by means of a brake and the coupling then used in the same manner as an "eddy-current" dynamometer.

METAL CLEANING as of TODAY

ANOTHER of the unexpected impacts of the war economy, this time a warning of an impending shortage of chlorinated solvents, has focused attention upon the vital role of metal cleaning processes in war production. As mentioned in AUTOMOTIVE *and* AVIATION INDUSTRIES, March 15, 1942, the War Production Board issued a news release dated March 2 requesting metal fabricators to investigate every alternate cleaning method in anticipation of a possible shortage of chlorinated solvents.

A quick survey of the situation intimates that evidently there is no actual shortage of chlorinated solvents, particularly since the fabrication of civilian supply items such as radios, refrigerators, and many other things in the same category has been completely stopped. Consequently, the "WPB 399" release may be interpreted as a means of warning production managers to prepare for some eventuality not now in the picture.

To those who have an accurate picture of the scope of metal cleaning in the automotive industry geared to war production, the situation presents many serious problems. To put it plainly, if a restriction on the use of chlorinated solvents is imposed in the future, it will imply more than just a shift to other types of metal cleaning preparations or metal cleaning procedures. Under ordinary circumstances the management has a choice of many makes and many types of cleaners that have made a good record of performance in the plants of the industry. But the present setting is much too involved for so simple a solution.

Consider that during the past year or more, many of the new war production plants, particularly airplane engine plants, have adopted solvent degreasing and, in some instances, have installed from 30 to 40 degreasing machines throughout the plant. Regardless of the basis on which metal cleaners may be evaluated, the fact is that these plants have taken advantage of the space economy afforded by the solvent degreasing equipment and have developed the layout of complete departments accordingly.

Again, regardless of the relative merits of metal cleaners, it is obvious that if the supply of chlorinated solvents were to be cut off due to conditions not yet a matter of public record, many plants engaged in war production will be confronted with the problem of what to do. So far as we can learn, this circumstance would rule out the use of degreasing machines now in operation. Doubtless some of the machines may be converted in some fashion, but in the main the degreasers might have to be dismantled and stored away against future use.

If this drastic step is taken there follows the problem of selecting suitable commercial cleaners of other types with the added complication of the installation of entirely different types of metal cleaning equipment. Such moves may be simple to make under normal operating conditions but in the midst of a war they would certainly entail a serious disruption of war production.

In the light of this appraisal it behooves everyone to look into the situation most seriously. Before any move is made to curtail the supply of chlorinated solvents, some one in authority must weigh the needs of the present production set-up as against any new demands upon the available supply of chlorine.

Perhaps an immediate and intelligent survey of the situation can do much to relieve the impending shortage. Consider the following recommendations:

1. The WPB release suggests that around 30 per cent of the cleaning operations now being done with chlorinated solvents can be accomplished with the use of other commercially available cleaners such as mineral spirits, alkalis, and non-chlorinated-solvent-water emulsions. Even if this is not an accurate estimate so far as the automotive industry is concerned, it is desirable to make a study immediately to determine what cleaning operations can be effectively handled by other means. And to determine which installations could be most readily replaced without disrupting production and departmental layout.

2. Several prominent suppliers of chlorinated solvents and degreasing equipment have ventured an estimate that from 25 to 30 per cent of the solvent is being wasted in existing installations through inefficient operation of the equipment. They explain that each machine is designed initially for a definite load—the capacity of a degreaser being a function of temperature and time. In many instances the machines are being overloaded, crowded beyond the original estimate of capacity, and under such conditions there is a serious wastage of solvent. The makers of Detrex degreasers, among others, are prepared to render immediate service to the end that more efficient operating conditions may be attained.

3. Finally, this focus of attention on a processing technique which may not have been given sufficient attention by management in the past should provide new incentive for a better understanding of metal cleaning in all of its ramifications. There is still time to make this a serious project for immediate research. A competent metallurgist or chemist assigned to this job can place metal cleaning on an exceptionally high plane of efficiency with the earnest cooperation of the suppliers.

In an effort to be of service to our readers in this important matter we offer a brief summary of reports obtained as expeditiously as possible from as many specialists as could be reached in the limited time available. Many others, no doubt, would have been glad to contribute had circumstances permitted. The reports presented herein provide at least the ground work for a survey of any individual plant.

Udylite in cooperation with MacDermid, Inc., recommends the use of pressure spray type washers with suitable types of alkali cleaners for steel and non-ferrous metals. When it comes to preparation for painting or plating, they recommend the use of organic emulsions in these machines. Mineral solvents can be employed in small hand type tanks, followed by a hand dip in a hot alkali bath. They prefer an electrolytic bath for alkaline cleaning in preparation for plating.

E. F. Houghton & Co., provides the following comments on the efficacy of alkaline metal cleaners: "These alkaline cleaners are usually classified into three groups: *Light duty* (generally used for maintenance cleaning and low in alkalinity); *medium duty* (not containing high percentage of caustic, and cleaning by emulsification); *heavy duty* (higher in caustic soda and cleaning by saponification with very little emulsifying).

"Metal cleaning compounds of today are much speedier and more capable of keeping up with production line demands than the types of a generation ago. Mechanized conveyor systems can be passed through cleaning baths, and the entire system may be streamlined efficiently.

"The most general demand for cleaning baths is to remove mineral oils, such as cutting oils, drawing compounds, etc., from metal parts preparatory to the next operation. For this work the alkaline cleaner is well adapted and is now in increasing use in a wide variety of plants. The equipment required for

(*Turn to page* 70, *please*)

Industry's War Effort Growing Apace

Chrysler, Buick, and Pontiac Announce Deliveries Far Ahead of Schedule; Fisher Body Gets New Ordnance Order

General Motors' deliveries of war materials to the government in the first quarter of 1942 are estimated at $237,450,000, representing a gain of 50 per cent over deliveries of $158,300,000 worth of war products delivered in the fourth quarter of 1941. In the 60 days following Pearl Harbor, GM war commitments were multiplied two and three-quarters times. In 1941 GM delivered war materials valued at $406,149,273 from its U. S. and Canadian plants, a gain of 442 per cent over the $74,857,798 worth of war products delivered in 1940.

The difficulties of conversion from peace-time products to engines of war was described by A. P. Sloan, Jr., GM board chairman, in contrasting two of the corporation's projects.

"A plant formerly engaged in the manufacture of automobile engines has been in the process of being adapted to the manufacture of aviation engines. In general, the buildings and supporting services have been utilized, although important building additions were necessary due to the specific demands of the new product to be produced. A portion of the production machinery has been found usable, but it was necessary to replace all the special tooling equipment with which the usable production machinery was originally equipped, and, in some cases, the machines themselves had to be reconstructed.

"Another division of the corporation had been charged with the production of an aviation engine of identical design. There was involved the construction of an entirely new plant in an entirely different location and under the direct supervision of one of our experienced operating organizations. Here, manifestly, all of the production machinery had to be provided as did the special tooling in both cases. In this case the first engine was produced eight months after the building project was started. In the former case production commenced about seven and one-half months after the plant shut down for the change-over. . . . Adapting existing plants represents a substitution rather than an expansion. It saves little time. The time factor is determined by the new machinery and the retooling."

The first named plant in which existing facilities were used was the Chevrolet engine plant at Tonawanda, N. Y. The second plant was that of the Buick aircraft engine division at Melrose Park, Ill. Both are building Pratt & Whitney 1200-hp. radial engines for army bombers.

Up to the end of 1941 GM spent $52,486,477 on its own account for the expansion of existing facilities and new construction for war production. A total of $69,279,797 was expended in the same period, financed by the U. S., Canadian and British governments, for expansion of facilities to be operated by GM. War industrial plant expansion in the U. S. through Dec. 31, 1941 totaled $7,366 million, of which $6,040 million, or 82 per cent, was financed by the U. S. or foreign governments according to the War Production Board. GM anticipates the expenditure of $14 million more of its own funds for war plant expansion, while an additional $349 million will be spent for the ac-

(*Please turn to page* 58)

WPB Outlines Grounds for Appeals

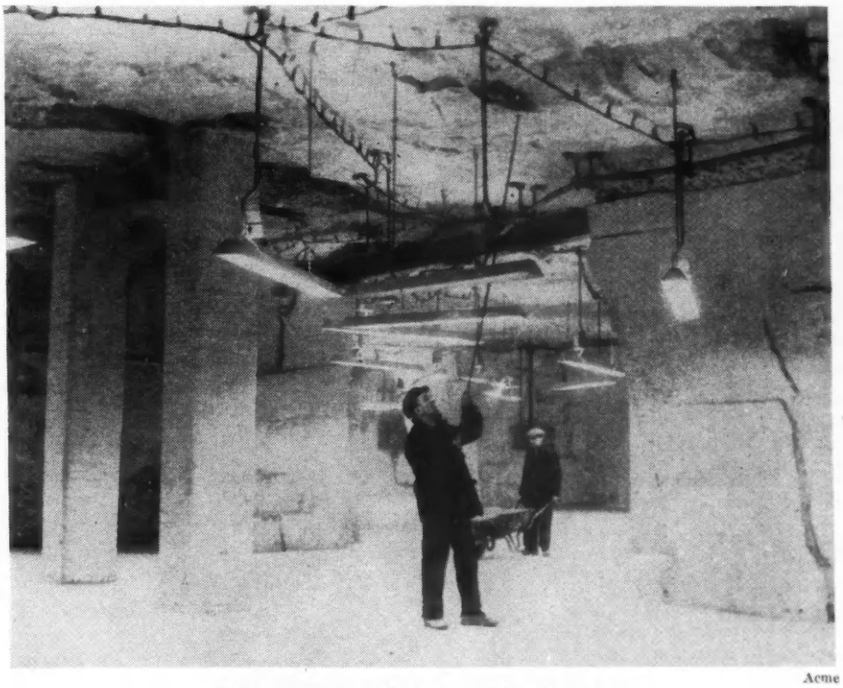
WPB recognizes six main grounds for granting appeals from "M" and "L" orders, according to a recent survey conducted by AUTOMOTIVE AND AVIATION INDUSTRIES of general appeals policy throughout the various WBP industry divisions. While the standards set forth are valid ground for relief, for the present at least, facts which a manufacturer submits in making an appeal must adequately support his claim. Several WPB officials have suggested that appeals be presented simply, and not in the form of a "red-ribboned lawyer's brief of 60 pages."

The following are grounds recognized by WPB with respect to relief from

(*Please turn ot page* 54)

Nash Gets Bomber Contract

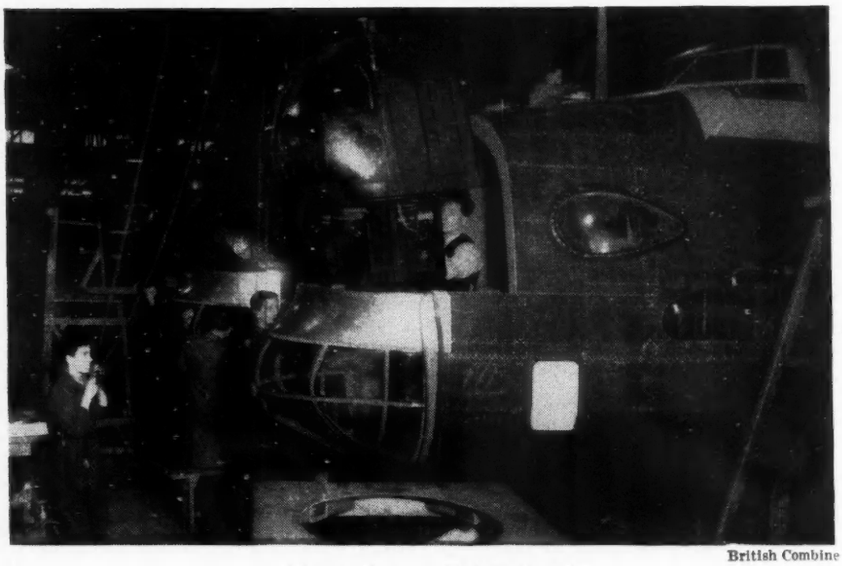
Nash-Kelvinator Corp. has been awarded a contract for the manufacture of Vought-Sikorsky four-motored flying boats, according to announcement by the U. S. Navy. Pratt & Whitney 2000-hp. 18-cyl. engines to power the planes will be made in the Nash plant at Kenosha, Wis. The plane will be the Excalibur-type flying boat.



Acme

Underground Aircraft Factory

Censors have passed the news that the British are using underground factories for the production of planes for the RAF. Modern luminous lighting and air conditioning furnish comfortable working conditions for "round-the-clock" production. A managing director controls operations through the use of a loudspeaker system. The workman in the foreground is testing the condition of the ceiling prior to the installation of new equipment in this bomb-proof factory.



British Combine

Nose for a "Halifax"

The photograph shows the installation of the front gunner's power-controlled turret in the nose of a Handley Page "Halifax". Among the largest four-engine bombers in use by the RAF, these planes are now in full production.

GM Announces War Service Program

Own Engineers Will Check Performance of Equipment in Field; Schools to Train Instructors for Army and Navy

Recognizing that its responsibility does not end when the truck, aircraft engine, or tank comes off the assembly line, General Motors Corp. has undertaken an extensive program to see that its war products in the field receive adequate service, that replacement parts are available and that the performance of war products in combat is studied so that improvements can be made and any deficiencies can be overcome.

In the words of O. E. Hunt, GM vice-president, "Our responsibility does not end until the product has been worn out in the hands of its user performing the service for which it was intended—and with a minimum of expense in time lost for upkeep and repairs."

General Motors will place its own engineers in the field, close to the battle-fronts, to make operating reports on equipment in war use and to make suggestions for improvement in manufacture. This service will be in charge of W. J. Davidson. Each manufacturing division with products in the field will be encouraged to set up its own engineer observer service. This will be supplemented by the corporation's organization, which will place one engineer observer in each Army area and one in each of the major theaters of war.

Thus it is conceivable that in some future war sector Fisher Body will have an engineer observing tank performance, Allison will have a man studying fighter plane engines, a Chevrolet engineer will be watching trucks and combat vehicles perform, Buick and Chevrolet will have experts observing bomber engines, a Detroit Diesel Engine Division representative will be looking over tank engines, and an AC Spark Plug man will observe machine gun operations. Similarly, a Cleveland Diesel Engine Division engineer might be with some task force of the U. S. fleet keeping tab on engine performance, and a Pontiac man might be on board watching Oerlikon anti-aircraft guns in operation.

"The goal of all of us," according to Mr. Davidson, "is to obtain field reactions to our products, both here and overseas, promptly and accurately. The need for such reports is obvious. Furthermore, good performance should be reported in an interesting way in order to stimulate our management and workmen to even greater effort."

The entire engineering, service, and spare parts program as it relates to war products is under the direction of C. E. McCuen, GM vice-president in charge of engineering.

General Motors also will see that spare parts are on hand for its war products in various parts of the world through cooperation with the GM Overseas Organization, which is well acquainted with the problems of transportation and supply in far corners of the globe. This parts distribution will be in charge of M. D. Douglas, Chevrolet parts and accessories manager. Chevrolet already has done consider-

(*Please turn to page* 60)

Business in Brief

Written by the Guaranty Trust Co. New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

General business activity has remained close to the peak established earlier this year. The seasonally adjusted index of *The New York Times* for the week ended March 14 rose to 133.7 per cent of the estimated normal from 132.3 for the preceding week and 121.4 a year ago. The unadjusted index of *The Journal of Commerce* for the same period is 122.6 per cent of the 1927-29 average, as against 121.4 a week earlier.

Department store sales for the week ended March 14, as reported by the Federal Reserve Board, were 24 per cent larger than in the similar period a year ago. Total sales in 1942 to that date were 27 per cent above last year's comparable figure.

Railway freight loadings increased more than seasonally during the second week of March, totaling 799,356 cars, a larger number than for any corresponding period since 1930 and exceeding by 5.2 per cent that of a year ago.

Bank debits in leading centers during the thirteen weeks ended March 18 were 16 per cent larger than in the corresponding period a year earlier.

Electric power production during the week ended March 14 declined more than seasonally but was 12.5 per cent larger than a year ago. This gain compares with one of 12.9 per cent a week earlier.

Bituminous coal production in the same period averaged 1,833,000 tons daily, as against 1,683,000 tons for the preceding week and 1,858,000 tons for the corresponding period last year.

Crude oil production during the second week of March averaged 3,515,300 barrels daily, 419,050 barrels below the figure for the preceding week and 277,400 barrels below the average recommended by the Office of the Petroleum Coordinator for the month.

Professor Fisher's index of wholesale commodity prices for the week ended March 20 stands at 103.8 per cent of the 1926 average, as against 103.6 a week earlier and 87.8 a year ago.

Member bank reserves declined $29 million during the week ended March 18. Business loans of reporting members increased $76 million to stand $1621 million above the total a year ago.

Sackett Joins SAE

Ray C. Sackett, former head of the public relations department of MacManus, John & Adams, Inc., recently joined the headquarters staff of the SAE to assist in the society's accelerating war program. He will have his headquarters in the New Center Building, Detroit, and will devote particular attention to working with the SAE War Engineering Board.

To Fabricate Plexiglas

Libbey-Owens-Ford Glass Co., Toledo, Ohio, under an agreement with Rohm & Haas Co., Philadelphia, will manufacture Plexiglas transparent plastic parts for aircraft.

Labor, Management Discuss Production Drive

WPB Proposes 10-Point Plan; Labor Wary of Changes in Contracts; Management Seeks Modification of Labor Demands

Representatives of the automotive industry pledged their support to Donald M. Nelson's production drive for a 25 per cent increase in output of tanks, planes, and guns at a labor-management conference March 24 at Detroit. This was one of 31 regional conferences held throughout the country at which consultants of the War Production Board explained the functions of the drive.

The Production Drive Plan Book published by the WPB sets up a 10-point program which a joint management-labor committee in each plant is to execute. Among the problems with which this committee should deal, according to the Plan Book, are taking care of tools, preventing accidents, providing good lighting, expediting maintenance and repair, studying plant efficiency, adapting old tools to new uses, breaking production bottlenecks, and using every machine to the fullest extent.

James S. Adams, former head of the Automotive Branch of OPM and now a consultant to Nelson, presided at the Detroit session, which was attended by 240 representatives of labor and 222 management representatives. Emphasizing the need for unity in the war crisis, Adams said it was essential to have the worker participate in doing the job better and that the job could only be done by men working together in the individual plants.

Tom Burns, chief labor consultant to the WPB, said that the committees should not touch bargaining questions nor should labor hope to bargain for a post-war era now. He said that management should discuss freely with labor the reasons for idle machinery so that mutual confidence could be built up.

Extensive production drive plans developed by Packard and Oldsmobile were shown to the meeting. These include production scoreboards, suggestion boxes, bulletin boards, slogan contests, award pins, plant posters, and inter-departmental competition. Packard's "Work to Win" program was presented by G. T. Christopher vice-president of manufacturing, and endorsed by Curt Murdock, president of the Packard CIO local. Oldsmobile's "Keep 'em Firing" campaign was presented by S. E. Skinner, general manager, and seconded by James Lindahl, president of the Olds CIO local.

C. E. Wilson, president of General Motors, speaking for management, said, "If these joint committees can help us all understand each other better, then they should be helpful." Wilson urged injection of the team spirit idea but cautioned that "we cannot accomplish more collectively if we do not do more individually." Replying to a direct question, Wilson said he viewed the joint committees as advisory to management, in which role they would be helpful in making suggestions and furthering cooperation. But as to having a direct voice in running the affairs of the plant, Wilson's answer was an unequivocal "no."

Wilson might have had reason to doubt labor's sincerity in view of the reaction of George F. Addes, secretary-treasurer of the UAW-CIO, to the GM plan for rewarding workers who make time-saving suggestions with defense stamps and bonds. Addes charged the GM plan would "make all production proposals from workers the private property of management."

Addes' charge came on the eve of negotiations between the UAW-CIO and General Motors for revision of the contract which expires April 28. Negotiations began in Detroit, March 19 and sessions are being held three times weekly. Several union demands. embracing the union shop to cover all GM employes, including office workers, and a flat $1-per-day wage increase, are almost certain to go to the War Labor Board for final decision. Other UAW-CIO demands include a shop steward for every 25 employes instead of for every 250 workers; five hours' call-in pay instead of two; raising the premium on the two night shifts to 10 and 15 per cent instead of the present 5 per cent as well as a 30-minute paid lunch period.

(*Please turn to page* 62)

WPB Modifies Aircraft Material Rating

WPB on March 12 abolished the rating distinction between material to be physically incorporated into aircraft products and other necessary materials used by companies producing military and naval aircraft, and reduced the rating of trainer planes from A-1-a to A-1-b, by mendment to Preference Rating Order P-109.

The change in the order in connection with materials means that materials indirectly as well as directly used in the production of planes will henceforth have the same rating. Ratings assigned by the amended order can be applied to purchase orders previously placed. All ratings are fully extendible. The order, however, cannot be used for obtaining machine tools, ratings for which must be obtained by the use of preference rating certificates.

DuPont Completes New Solvent Plant

As part of its program directed toward sufficient production capacity for the war effort, E. I du Pont de Nemours & Co. is completing another plant for the manufacture of trichlorethylene. According to company officials, enough raw materials will be available to keep all units in operation.

Geschelin Addresses SAE

Joseph Geschelin, Detroit Technical Editor, Chilton Automotive Publications, will address the first regional meeting of the Detroit Section, SAE, in Toledo on April 6.

He will talk on the influence of automotive mass production methods on the production of war materials.

Acme

Super Jeep

This experimental model of an 8-wheel "super jeep" carries retractable side wheels which can be lowered to assist in lifting the front wheels out of deep ditches and culverts. Propelled by a four-wheel rear drive, the truck carries a crew of four and one 37-millimeter anti-tank gun as standard equipment.

Monthly Motor Vehicle Production

(U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1942	1941	1942	1941	1942	1941
January	152,107	423,223	107,905	100,850	260,012	524,073
February	.....	405,160	.....	104,172	.....	509,332
March	.....	422,289	.....	111,589	.....	533,878
April	.....	387,070	.....	102,786	.....	489,856
May	.....	427,538	.....	117,817	.....	545,855
June	.....	427,521	.....	118,757	.....	546,278
July	.....	347,597	.....	121,300	.....	468,897
August	.....	81,689	.....	83,104	.....	164,793
September	.....	170,338	.....	78,413	.....	248,751
October	.....	301,203	.....	100,166	.....	401,369
November	.....	263,104	.....	110,788	.....	373,892
December	.....	181,613	.....	120,905	.....	302,518
Total	.....	3,838,345	.....	1,270,647	.....	5,108,992

Car Conservation Plan Urged for Nation

Safety Foundation Arranges Nationwide Test of Pontiac, Mich., Scheme; Features Staggered Shifts, "Ride Swapping"

After studying the results of a war transportation conservation plan worked out in Pontiac, Mich., with the cooperation of the Michigan State Highway Department, the Automotive Safety Foundation has decided to launch the plan on a national scale in an effort to conserve motor vehicles and tires.

Pontiac, a highly industrial city of 62,000 population 20 miles north of Detroit, was chosen by the Michigan State Highway Department for the experiment. The plan is not completely efficient yet but within a few weeks it is hoped that substantial results will be achieved. Briefly, the plan required the later opening of schools and stores, the staggering of factory shifts and the more complete utilization of private automobiles.

Preliminary surveys showed that 20,000 of Pontiac's 26,000 industrial workers used private automobiles to reach their work. The 12,111 workers residing in the city used 9359 vehicles, a ratio of 1.37 riders per car, while the 9322 workers living outside the city limits used 5793 cars, a ratio of 1.5 riders per car. The city's 34 buses carried only 4400 workers to the plants. By staggering shifts and revising bus schedules, it is hoped to double the number of workers using public transportation.

Shifts at the Yellow Truck & Coach Mfg. Co. in the southern section of Pontiac now begin at 6.30, 7.30 and 8.30 a.m., diffusing the traffic load on the streets and bus system. Shifts at the Pontiac Motor and Fisher Body division of General Motors in the northern part of Pontiac now start at 6, 7 and 8 a.m. Meanwhile, Pontiac's downtown stores have deferred their opening from 9 to 10 a.m. and now operate on a 10 to 6 basis rather than 9 to 5. High schools and junior high schools have delayed their openings 25 or 30 min. to 9 and 9.15 a.m.

Organized labor has been cooperative in helping promote "ride sharing clubs," through which four neighboring workers come in one car. This conserves tires and a worker has to drive his own car only once in four days. This is being promoted through an educational campaign in which "Let's Ride Together" windshield stickers and buttons are used. Parking lots at plants also are divided so that workers residing in the same part of town will park together and ride "swapping" will result. Ideally, it is hoped that the more than 15,000 automobiles that bring workers to the factories can be reduced to 4500 vehicles by the most complete utilization of these private transportation facilities. But this part of the plan will take some time to perfect.

Request Decreased Use Of Additives in Oils

Immediate reduction in the quantity of scarce chemicals used as additives in automotive lubricating oils and greases was requested in a formal recommendation (No. 40) issued to oil refiners and distributors by the Office of the Petroleum Coordinator.

Oil refiners are asked, under the recommendation, to reduce or eliminate completely the use of certain additives in lubricants for passenger cars, light delivery trucks, taxicabs and business cars. No changes are recommended, however, for lubricants used in heavy-duty equipment, police cars, ambulances, buses or cars in official use by the armed forces.

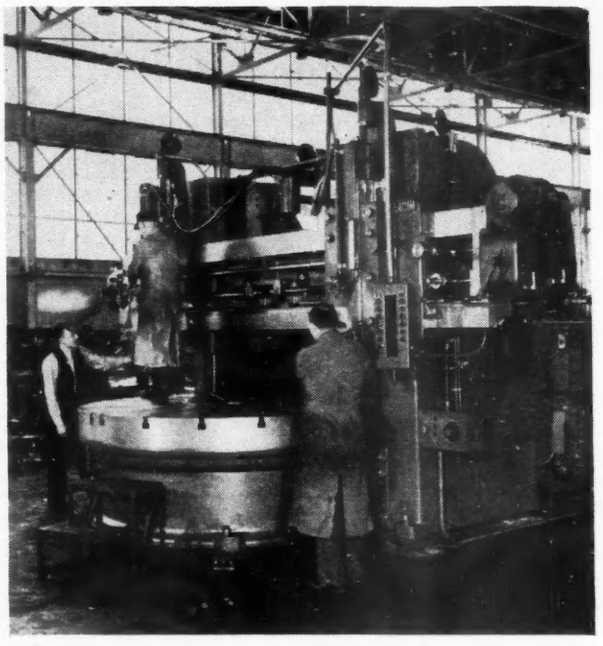
Eliminated completely for use in additives to lubricants for passenger and other light cars are cresol, metallic detergents, and chlorine for chassis lubricants. No extreme-pressure lubricants may be used in the transmissions of passenger and other light cars. Reduced use of additives is recommended for oxidation-inhibitors and pour-point depressants. Elimination, where possible, of extreme-pressure lubricants in transmissions of all heavy-duty equipment was also asked.

Albert Fisher

Albert Fisher, 78, one of the founders and first president of the Fisher Body Co., died March 14 at Detroit. After an apprenticeship in the carriage bilding business, he formed his own company and built the first touring car body for Henry Ford. He was one of five organizers of the Fisher Body Co. in 1908. He incorporated the Universal Motor Truck Co. in 1910 and was owner of the Standard Motor Truck Co. from 1913 to his retirement in 1929.

Fisher Builds Machine Tools

Barely more than two months after Fisher Body contracted to build 100- and 112-in. boring mills for tank production, the first mill was completed and ready for delivery. The photograph shows the first vertical boring mill to be given final inspection



CHECK these advantages of the Torrington Needle-Bearing—advantages that have been tested and proved in thousands of applications—and see how every feature can be utilized to fill a wartime need in *your* product designs.

1. *The Needle Bearing is available for prompt delivery* on priority orders, in the standard sizes and designs that are most practicable today. Production capacity at Torrington has been expanded to care for all essential requirements with the promptness you need to maintain your manufacturing schedules.

2. *It is easy to install,* ideally suited for high-speed production line methods. Built as a single compact unit, the Torrington Needle Bearing is pressed into place in the housing in a quick, simple operation.

3. *It conserves materials* in other parts of your product design. Because the bearing's outside diameter is small in proportion to capacity, you can use small-diameter housings, requiring less material.

4. *It improves product performance* and reduces power requirements, because of its low coefficient of starting and running friction.

5. *It needs little attention* in service. As a result of its efficient system of lubrication, only occasional renewal of lubricant is necessary. Its high load capacity assures long bearing life, even in continuous operation under heavy loads.

Let a Torrington engineer show you how this unusual bearing can help you key your designs to wartime conditions. For details, wire, phone or write for Catalog No. 107.

THE TORRINGTON COMPANY
TORRINGTON, CONN., U. S. A. • *Estab. 1866*
Makers of Needle and Ball Bearings
New York Boston Philadelphia Detroit
Cleveland Chicago Los Angeles Seattle
San Francisco Toronto London, England

EVERY FEATURE
FILLS A WARTIME NEED

TORRINGTON NEEDLE BEARING

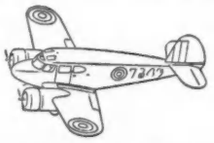
INCREASED EFFICIENCY

Torrington Needle Bearings reduce power consumption in the "Lockformer" line of sheet metal working equipment—and with thousands of machines in daily use over a five-year period, bearing replacement has been negligible. Compactness of the bearings is an additional advantage.

THE LOCKFORMER COMPANY

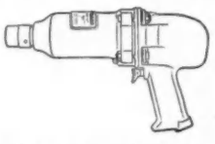
ELIMINATION OF WEAR

The Needle Bearing's low coefficient of friction virtually eliminates wear in the control column of the CESSNA T 50. Replacement costs are kept to a minimum at points where Needle Bearings are used, which include landing gear, aileron hinge, and wing flap hinge.



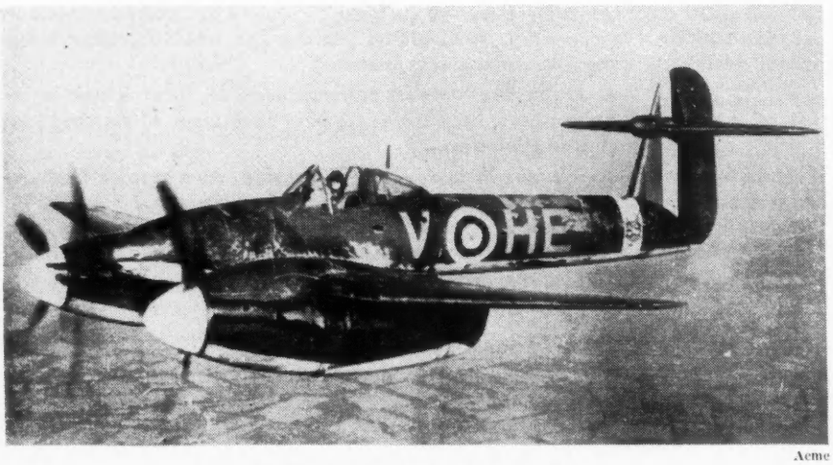
CESSNA AIRCRAFT COMPANY

LIGHTNESS IN WEIGHT



Light weight and small size in proportion to power rating are outstanding features of air-operated portable tools. Compact, high-capacity Needle Bearings aid in attaining these desirable features in this impact wrench manufactured by Ingersoll-Rand Company.

INGERSOLL-RAND



Acme

Westland "Whirlwind"

The Westland "Whirlwind", an RAF fighter, is a new ship capable of guarding bombers in flights as far as Antwerp. Supplied with four 20-mm cannon mounted in the streamlined nose, the "Whirlwind" flies under the power of two 850-hp. Rolls Royce engines. Note the construction of the tail planes.

Pig Iron Output Mounting Steadily

Steel Producers, however, Face Problems of Frequent Shifts in Production Procedure to Meet War Demands

by W. C. Hirsch

Although steel production as a whole has been stepped up to record-breaking tonnages, it is recognized in Washington that, in order to obtain an adequate supply of those descriptions of finished steel of which there happens to be the greatest need at a given time, control must be extended to the intricate system of allocating the primary forms to the various finishing units. While regulations to that end are under consideration, those charged with supervising the speeding up of the kinds of finished steel, of which there is at the moment the greatest need, are well aware that what this program calls for above everything else is flexibility.

Today the greatest need may be for steel plates and bars, but this may change as the Army and Navy lay greater emphasis on equipment now not so much in the foreground as ships and tanks. In normal times the scheduling of finishing department operations, always a task for the most competent experts, is influenced on the one hand by considerations of economy and the holding down of production costs through avoidance of unnecessary change-overs, and on the other hand by compliance with delivery dates. The first of these has already had to be considerably modified in order to accord to orders with the highest ratings the preference to which the war importance of the product entitles them.

Pressure by those with very high ratings, however, frequently makes it difficult for the steel manufacturer to satisfy all, and whether this can be accomplished through even the most carefully worked out regulations is problematical. It isn't any longer a question of determining the importance of each order on its own merits, but of following it through so that extraordinarily urgent material has the right of way over only ordinarily urgent material, carrying perhaps a similar rating.

After all, the production of war material can hardly be expected to be more static than war itself, and regulations and methods, adequate today, may have to be altered tomorrow. While by no means sufficient, the supply of scrap is beginning to make a somewhat better showing in spots. In Detroit, industrialists are hard at work to bring out additions to the scrap pile from heretofore untapped sources.

Pig iron production is becoming more and more impressive from day to day, and this will have to be so, if the deficiency in the scrap iron supply is to be made up for. It remains to be seen whether a process for recovering chromium from low-grade American ores, worked out by United States Bureau of Mines metallurgists, can be made industrially available in the near future. Dr. R. R. Sayers, Director of the Bureau of Mines, has stated that the practicability of the process will depend for the present largely on the availability of chlorine, essential in gaining the chromium from the ore.

The use of all "bright work" materials in the finishing of automobile parts and accessories has been prohibited by WPB. Besides chromium, these materials are alloys into which aluminum, cadmium, copper, or nickel enter.

MEN . . . . . .

T. E. Brents, former assistant manager of the Chevrolet retail sales promotion department, has been named manager of the sales merchandizing department, succeeding **E. F. Hayes,** who has been promoted to zone manager of the Oklahoma City Zone. Hayes succeeds **H. Z. Wellinger,** who was recently named to the Detroit Defense Section of the Operating Staff of General Motors.

Thomas H. Parramore, of The White Motor Company, has been named service manager in charge of the Federal Division for the duration of the war.

Louis W. Wulfekuhler, formerly assistant secretary of Lockheed Aircraft Corp., Burbank, Calif., has been elected secretary of the Corporation.

Earl Herring, formerly vice-president and general manger of the Kinner Motors, Inc., Glendale, Calif., was elected president and general manager to succeed **B. B. Robinson,** resigned. Mr. Robinson also withdrew from the board of directors and was replaced in that position by **Victor Ford Collins,** Los Angeles attorney.

I. B. Babcock, president of Yellow Truck & Coach Mfg. Co., has been appointed consultant on buses, trucks, taxicabs and replacement parts to the Materials and Equipment Section of the Office of Defense Transportation. Other consultants include Robert F. Black, president of White Motor Co., for equipment on which production has been suspended, including fire fighting apparatus and road working equipment, and H. L. Hamilton, general manager of the Electro-Motive Division of GM, for railroad diesel engines.

Byron C. Foy, vice-president of Chrysler Corp., has been elected to the board of directors of National Dairy Products Corp.

Norman E. Donnelley has been named district manager for the Washington office of the Buda Co. He succeeds Col. H. H. Frost, who has returned to active duty with the U. S. Army.

Ronald R. Monroe, formerly executive vice-president of the Utilities Power & Light Corp., Chicago, has been elected vice-president in charge of manufacturing and purchasing for J. G. Brill Co. Monroe and Charles O. Guernsey, vice-president in charge of sales engineering and service, have been elected to the board of directors.

J. B. Fenner, formerly assistant treasurer, has been elected treasurer of Electric Auto-Lite Co.

Robert F. Black, president of White Motor Co., has been elected to the board of directors of the Gabriel Co., succeeding **Arthur S. Laundon,** who has resigned to enter the Army. **C. R. Wefler,** formerly treasurer and assistant secretary, has been elected secretary-treasurer.

Fred W. Cederleaf, formerly works manager of the Dodge Mfg. Corp., Mishawaka, Ind., has been named plant manager in charge of Detroit plants of Republic Aircraft Products Division of Aviation Corp.

Randolph W. Heizer has been appointed Detroit manager for J. Stirling Getchell, Inc., New York advertising agency servicing the Plymouth and De Soto accounts. He succeeds Harry T. Mitchell who has resigned as a vice-president of the agency.

George W. Mason, president of Nash-Kelvinator Corp., has been elected a director of the Square D Co., Detroit, manufacturer of electrical equipment and aircraft instruments.

Robert A. Lambeth, treasurer; **Raymond H. Rice,** chief engineer, and **J. S. Smithson,** general manufacturing manager, have been elected vice-presidents of North American Aviation, Inc.

Carl Apponyi has been appointed director of public relations for Northrop Aircraft, Inc.

Gordon C. Sleeper, formerly asociated with the brokerage firm of Reynolds & Co., has been named assistant to the president of Republic Aviation Corp.

(*Please turn to page* 60)

PRACTICAL DATA FOR PRESENT PROBLEMS

Here are two books designed to help users of Molybdenum steels and irons to conserve all alloying elements, and possibly steel and iron, by getting the most in the way of strength, toughness and wear resistance with the lowest alloy content.

"MOLYBDENUM IN STEEL" covers the fundamental metallurgy of Molybdenum steels. Heat treatment – physical properties – applications – of a number of these steels are treated at length.

"MOLYBDENUM IN CAST IRON" covers the effect of Molybdenum in gray iron, giving suggested analyses for practical applications and detailed discussion of high strength (60,000 p.s.i. and up) irons.

Both books will gladly be sent free on request.

Climax Molybdenum Company
500 Fifth Avenue • New York City

MOLY

Passenger Car and Truck Production
(U. S. and Canada)

	January 1942	December 1941	January 1941	Per Cent Change Jan. 1942 over Jan. 1941
Passenger Car Production				
United States plants	147,858	174,962	411,233	− 64.0
Canadian plants	4,249	6,651	11,990	− 64.6
Total	152,107	181,613	423,223	− 64.0
Truck Production				
United States plants	90,403	107,243	89,645	+ 1.0
Canadian plants	17,502	13,662	11,205	+ 56.1
Total	107,905	120,905	100,850	+ 7.9
Total—United States plants	238,261	282,205	500,878	− 52.3
Total—Canadian plants	21,751	20,313	23,195	− 6.1
Total—Cars and Trucks—U. S. and Canada	260,012	302,518	524,073	− 50.3

Gas Rationing Preference List

Deliveries of gasoline to service stations and bulk consumers in seventeen Eastern states, the District of Columbia, Washington and Oregon was cut by one-fifth beginning last month. This curtailment, designed to conserve gasoline in areas to which it must be transported over considerable distances, is prescribed by Limitation Order L-70, issued by the Director of Industry Operations upon recommendation of the Office of Petroleum Coordinator.

The order directs service stations to give preference in supplying gasoline to physicians, surgeons, nurses, veterinarians, government-owned vehicles, commercial vehicles including taxicabs, and also for use in commercial, industrial and agricultural machinery and equipment.

Scrap Rubber Use Strictly Controlled

As a result of a serious shortage of scrap rubber, strict controls on the use and sale of scrap and reclaimed rubber were put into effect March 21 by the War Production Board.

The restrictions, which permit consumption for designated products only, are contained in Amendment 6 to Supplementary Order M-15-b. After March 31, the use of reclaimed rubber is banned except for limited purposes.

CALENDAR

Conventions and Meetings

Natl. Petroleum Assoc., Cleveland, O., April 16-17

Midwest Power Conference, Chicago, April 9-10

American Foundrymen's Assoc. Annual Convention, Cleveland, O.....April 20-24

Chamber of Commerce of U. S., Annual Meeting, Washington, D. C..April 27-30

Assoc. of American Battery Manufacturers Spring Meeting, Cincinnati, May 7 and 8

Natl. Metal Trade Association, Annual Convention, New York City, May 19-20

Society of Automotive Engineers, Semi-Annual Meeting, White Sulphur Springs, W. Va. .....May 31-June 5

Natl. Metal Congress & Exposition, Detroit .....Oct. 12-17

Brightwork Banned In Replacement Parts

The War Production Board has extended the ban on use of "bright work" to all types of motor vehicles and trailers, prohibiting its use in replacement parts and accessories, and placed rigid restrictions on disposal of remaining inventories.

As in the past, the prohibition does not apply to "bright work" used in ventilator window latches, external locks, cylinder caps and covers, external windshield wipers, windshield wiper arm and blade assemblies, and body trim screws.

Sub-Contracting Directory for Chicago

A directory of war work to be subcontracted will be tried on a limited scale in the Chicago area in the near future, it was announced by William H. Harrison, Director of Production of the War Production Board.

In the test, selected prime contractors will list the work they have to be done, by separate parts, classifying each by the machine needed to make it, the tolerances required and the hours per week these machines have to work.

Camelback Allotment Increased for Retreaders

Provisions for an original allotment of 300 lbs. of truck type camelback to retreaders and recappers for certain small gauge truck tire molds and additional allotments for retreading or recapping machines capable of treating more than one tire at a time are contained in Amendment No. 2 to Revised Tire Rationing Regulations recently issued by the Office of Price Administration.

Under the amendment, each machine that can recap or retread two or more tires simultaneosly will be allowed a maximum of 1500 lbs. of truck camelback instead of 750 lbs.

Lindbergh Joins Ford

Charles A. Lindbergh has accepted a position in the engineering research department of the Ford Motor Co.'s bomber plant at Willow Run.

PUBLICATIONS

The Firestone Tire & Rubber Co. has published a new booklet giving in detail the rules for the **proper care of truck and bus tires** and containing suggestions which will enable truck and bus operators to obtain every possible mile of service from their present tires.

The Fruehauf Trailer Co. has presented, in booklet form, a study concerning the all-important job of **moving war materials**, the importance of motor transportation in the war program.

O'Neil-Irwin Mfg. Co.'s catalog No. 42-1 describes and illustrates the **Di-Acro System of Metal Duplicating without dies.** Included with the catalog is a price list of the various Di-Acro machines.

As a sequal to the publication, Advertising Today, Evans Associates of Chicago has brought out a 24-page compilation presenting suggested ways in which manufacturers may profitably advertise under present day conditions when the usual landmarks seem to be blacked out. A line of thought is developed for executives on a long-range-planning basis.

Whiting Corp. has prepared and assembled in a loose-leaf binder a collection of catalogs covering its line of **foundry equipment, cranes, impact pulverizers, casting cleaning equipment,** and similar products.

The B. F. Goodrich Co. has prepared, in a pocket-size format, the first four of a series of six pamphlets on **How to Get the Most Service Out of Industrial Rubber Products.** Four relate to belting and are as follows: **Transmission Belting; Conveyor Belting; V-Belt Drives** and **Belt Salvage.**

A folder published by Alpha Metal & Rolling Mills, Inc., describes its **lead and tin** products and includes lead-tin alloy tables.

A new TAG Catalog No. 1101 G, issued by C. J. Tagliabue Mfg. Co., describes and illustrates many improvements and numerous new instruments manufactured by this company.

Caterpillar Diesel . . . On Guard is the title of a 32-page booklet that describes and illustartes the part played in the victory program by Caterpillar Tractor Co.

Ohmite Catalog No. 40, published by Ohmite Mfg. Co., has been designed to be a handy reference for all resistance applications. Information regarding stock units —resistors, rheostats, tap switches, chokes, etc., can be found quickly on pages indicated by an edge of color.

C. O. Bartlett and Snow Co. is distributing its new complete **Heat Engineering Catalog** describing the company's Continuous Rotary and Batch Dryers, Calciners, Coolers, Rotary and Batch Kilns, etc., and the applications for which each has been designed.

Sterling Tool Products Co.'s new manual **Hints on Aircraft Sanding With Sterling Speed Bloc Sander** gives a list of recommended abrasives for sanding operations on airplanes.

Bulletin No. G-427, Reeves Pulley Co., describes and illustrates its new type **electric remote speed indicator** for use with Reeves Variable Speed Control Equipment.

A folder describing and illustrating **Rex Sanitation Equipment** has been published by Chain Belt Co. It gives technical information concerning Rex Slo-Mixers.

Coonley Gets WPB Post

Howard Coonley of the Walworth Co. will head the Simplification Branch of the Bureau of Industrial Conservation of WPB. He is a past president of the American Standards Association and has for many years been closely associated with its work.

A NETWORK OF SUPPLY POINTS

to keep your assemblies at double speed

YOU'LL find it relatively easy to get all the Phillips Screws you want, in various types, head styles, sizes and metals.

19 screw manufacturers are ready to furnish Phillips Screws.

Over 200 sales engineers are available to help fit the Phillips Screw into your assembly set-up for maximum efficiency and lowest cost.

On the average job, manufacturers have cut 50% from assembly time. The Phillips recess has been so carefully engineered and controlled that you can expect to eliminate all the nuisances that delay assembly work. The driver fits the recess so snugly that you can avoid fumbled screws, slantwise driving, screwdriver slippage, burrs, etc.

At the same time, fastenings are much stronger, because Phillips Screws set up tight without splitting the heads.

Today, the majority of aircraft and automotive manufacturers assemble with Phillips Screws.

Speed product deliveries by saving assembly time **Specify Phillips and Save 50%**

PHILLIPS RECESSED HEAD SCREWS

WOOD SCREWS · MACHINE SCREWS · SHEET METAL SCREWS · STOVE BOLTS · SPECIAL THREAD-CUTTING SCREWS · SCREWS WITH LOCK WASHERS

Nash to Defray Dealers' Storage Costs on New Cars

Nash-Kelvinator Corp. has announced a plan of monthly cash advances to help its dealers remain in business and maintain their service organizations for the duration. Under the plan Nash dealers can obtain an advance of $10 per car for every month that a new car is held between Februry and either the date of sale or March 15, 1943. This will enable dealers to meet storage, finance and insurance costs while the cars are awaiting sale to a buyer with a ration certificate.

WPB Appeal Routine

(*Continued from page 45*)

materials and limitation orders:

1. If the granting of an amount of scarce material will hasten the firm's conversion to war production, permission may be granted to accelerate its production or scarce material consumption to cover up to 120 per cent of the firm's quota as set by the order for the period required for conversion, if such conversion is to be 80 per cent or more and will proceed without substantial interruptions.

If conversion will be speeded, a firm may be allowed to produce replacement parts or other articles that will be needed for essential civilian products during any period up to three years after the effective date of the appeal decision, provided conversion to war production is to be 80 per cent or more, and if it is not feasible to have such replacement parts made by other firms.

If conversion will be quickened, permission to finish semi-fabricated inventory on hand will be granted if such inventory will be a serious impediment to conversion, to war production, or cannot be retained, used, or sold for other purposes without serious financial loss, and will require only relatively small amounts of scarce material for its completion and no satisfactory substitutes for such material can be found to manufacture relatively essential end-products.

Miscellaneous grounds for relief based on the fact that, if granted, they will speed conversion are: to hold personnel organization intact; to take over the quota or obligations of another firm which is converting to war production, if WPB approves; to produce or acquire any equipment or supplies which will facilitate the firm's conversion needed to carry out any other action in accord with the foregoing.

2. If conversion will be facilitated by the granting of an amount of scarce material that will not exceed the amount that will be saved in one year by the conversion, an appeal may be granted if it be shown that simplification or substitution will result in the saving of substantial amounts of scarce materials in the making of an essential civilian product. The same bases for appeal may be set forth which are indicated in Item 1.

3. If a limitation order would impose exceptional or unreasonable hardship upon a firm's production of essential civilian products, it may be shown that at the time of the order's issuance the firm did not exist and therefore could not limit its production on the basis of a period when it was not doing business. Or it may be shown that during the base period of the order, upon which production was to be limited, the firm experienced sub-normal operations because of non-economic reasons such as fire, flood, construction, etc.

Relief may be granted from the terms of a limitation order which restricts certain materials, if a company can show that its production during the base period designated in the order was confined largely to types of product, or involved the use of substantial quantities of raw materials, not covered by the order.

Relief may likewise be given if it be shown that the amount of scarce material the firm requests is either exceptionally small or cannot be replaced by a substitute material without unreasonable expense or expenditure of other materials.

4. Unemployment which an order may cause is adequate ground for granting an appeal, if the amount of scarce material consumed per man-hour is relatively small, and if the workers involved are not suitable for other employment, or cannot find other jobs within a reasonable time. It may be further shown that the resulting unemployment will cause the loss of skills or crafts that are deemed by WPB too important to be sacrificed.

5. An appeal may be granted if it is shown that substantial competitive inequities arose from lack of uniformity in the administration of orders, or incorrect reports connected therewith, or to permit a company to take any action which is in full accord witih the intent of an order but was inadvertently prohibited by it.

6. If the making of certain replacement parts or supplies is deemed to be non-essential to the United States, but proper authorities have said they are desirable for export to create foreign exchange or for other reasons, an exception may be granted.

Also, a firm may be permitted to take any other action deemed by proper authorities to be necessary to lend-lease or other economic programs—the acquisition of excess inventory of scarce materials, or the exceeding of production quotas for export purposes.

or a Tank at Half-a-Mile

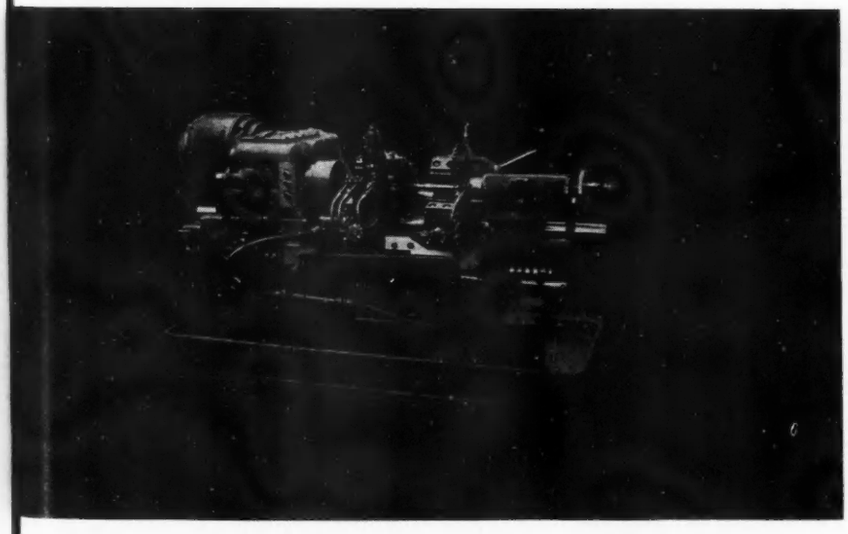
In 1838 it may have been quite a feat to turn out a rifle that would put three bullets in a sap hole at 12 rods, but today's emergency demands accurate machine gun fire at 1500 yards, cannon that can hit a fast moving tank over half a mile away and antiaircraft guns that destroy five-mile-a-minute targets at 20,000 feet.

In any day and time, the technique of producing weapons that hit precisely where you aim them demands similar fundamentals of machine tool engineering and workmanship. Just as Lawrence understood those fundamentals and applied them in his generation, so did Robbins, Hubbard, Howe, Lamson, Hartness and scores of other engineers in Jones & Lamson Machine Company and its predecessor shops.

So do present day Jones & Lamson engineers design equipment that sets new standards of speed and accuracy today. Such are the Jones & Lamson Fay Automatic Lathes, pictured here on multiple tooled precision work on weapon barrels, capable also of cutting costs on peace-time tasks like shafts and spindles.

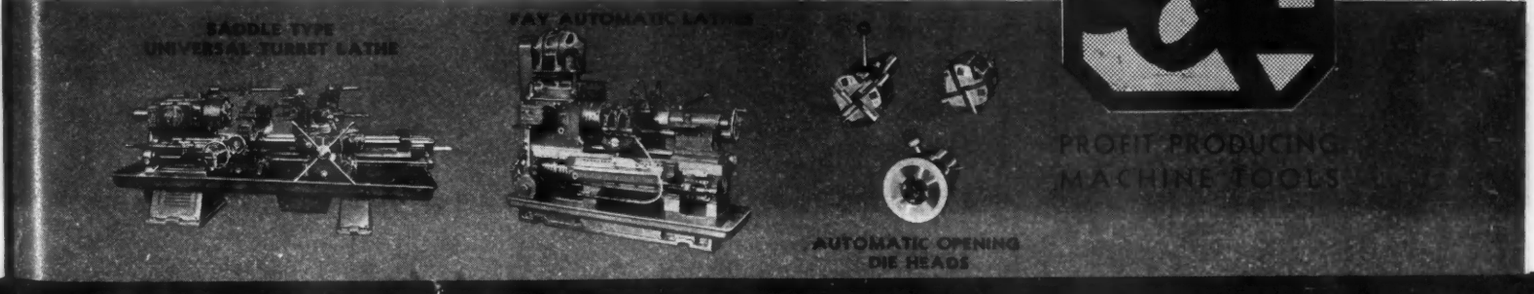
Here is another timely example of why it pays two ways to put production problems up to Jones & Lamson engineers. Why not see what they can do to help you? Inquiries from large plants or small receive thorough study here.

JONES & LAMSON
MACHINE COMPANY · Springfield, Vermont, U. S. A.



Jones & Lamson 8″ x 33″ Fay Automatic Lathe tooled to machine an automatic rifle barrel.

Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers



Industry's War Effort

(*Continued from page* 45)

count of many government agencies.

Chrysler Corp. has undertaken a $66 million expansion program to meet increased production schedules on armaments. In order to triple the capacity of the Chrysler Tank Arsenal, which completed its first order seven months ahead of schedule, a $40 million addition is under way to provide for three more final assembly lines, boosting the total to six. For the 30-day period ending March 19, production at the tank arsenal was 38 per cent higher than the previous 30-day period and almost double the total of the first four months' output.

Chrysler also is spending $20 million to expand its ammunition making facilities, in which volume production already is under way on some items. Another $6 million tooling and equipment program is required to expedite a five-fold increase in output of Bofors anti-aircraft guns. The new aluminum alloy forging plant is in production on duralumin aircraft forgings and the assembly of B-26 bomber fuselage sections has begun at a Detroit plant. More than 100,000 Dodge trucks have been delivered to the Army, and production will soon be under way on a new type of combat vehicle. Chrysler expended $24,451,475 for the account of the U. S. government in 1941 for war production facilities.

Pontiac's shipments of Oerlikon anti-aircraft guns in the past few months have been at 30 times the rate originally called for in the contract, according to Harry J. Klingler, general manager.

Automotive Council Forms War Aid Division

Formation of the Military Vehicles Division of the Automotive Council for War production to speed the output of combat and other military units by all the manufacturers of motor trucks, buses and trailers has been completed. One hundred and twenty-five representatives of 62 companies attended the organization meeting at Detroit March 24. Irving B. Babcock, president of Yellow Truck & Coach Mfg. Co., one of the largest producers of military trucks, was elected chairman of the division's governing board.

Other members of the governing board are Robert F. Black, president of White Motor Co.; P. V. Moulder, vice-president of International Harvester Co.; E. J. Bush, vice-president of Diamond T Motor Car Co.; R. I. Roberge, of Ford Motor Co.; L. J. Purdy, general manager of the Dodge Truck Division, Chrysler Corp.; W. A. Olen, president of Four Wheel Drive Auto Co., all representing the truck industry, with W. G. Sternberg, president of Sterling Motors Corp., as alternate. Charles Guernsey, of American Car & Foundry Co., was elected to represent the bus manufacturers and Harvey Fruehauf, president of Fruehauf Trailer Co., and M. J. Neeley, of Hobbs Mfg. Co., were named to represent the trailer makers.

The commercial vehicle manufacturers passed a resolution pledging their cooperation in bringing their full facilities and resources into play in providing the armed forces with combat and other military vehicles. Complete inter-change of production information, time-saving techniques, product improvements and tooling short cuts has been promised. Committees were appointed in order to deal better with problems of production, engineering, parts output and distribution. These committees will meet at least once a month.

Return Tires by April 15

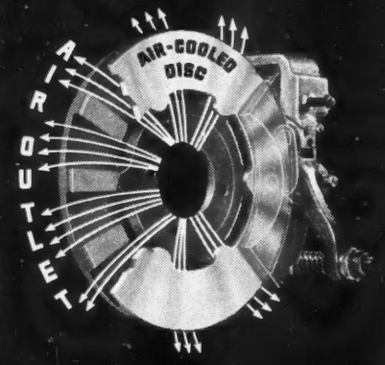
Tire dealers and jobbers who are selling new tires and tubes back to manufacturers must actually ship such rubber before April 15, according to the OPA. This has been extended from the previous deadline of March 31.

Henry M. Lucas

Henry M. Lucas, organizer of The Lucas Machine Tool Co., died at his home in Cleveland last month.

Above • New, All-Steel 125 ft. Ladder Equipment with **TRU-STOP** *Emergency* **BRAKES**—Manufactured by American La France for Boston Fire Department.

Right • Four-Wheel Drive production for the U. S. Marines—equipped with **TRU-STOP** *Emergency* **BRAKES.**



THE TRU·STOP "VENTILATED" DISC MAKES TRU·STOP EMERGENCY BRAKES SERVE BETTER AND LAST LONGER

HERE IS A THOUGHT ON BRAKES FOR AUTOMOTIVE EXECUTIVES—

Among those who hold a determination to provide bus and motor truck safety under *all* driving conditions . . . among those who give full consideration to the safe control of buses and motor trucks in motion . . . where they have analyzed the risk that attends an insecurely parked vehicle . . . among those there is a definite tendency to install **TRU-STOP** *Emergency* **BRAKES.**

The critical raw material situation gives you another good reason to offer the protection of **TRU-STOP** *Emergency* **BRAKES** to buyers of equipment you are able to deliver.

If your production—or part of it—is particularly well situated under present regulations, let us give you all details.

AUTOMOTIVE & AIRCRAFT DIVISION

6-235 GENERAL MOTORS BUILDING, DETROIT • 695 BRYANT STREET, SAN FRANCISCO

TRU·STOP *Emergency* **BRAKES**

In Business for Your Safety

ACCO

AMERICAN CHAIN & CABLE COMPANY, Inc.

BRIDGEPORT • CONNECTICUT

MEN

(*Continued from page* 50)

R. L. Wilcox, metallurgist for the New Jersey Zinc Co., Chicago, has been loaned to the War Production Board, Bureau of Conservation, and will be located in Washington.

Otto Franke, formerly general master mechanic, has been appointed general works manager of the Dodge Division of Chrysler Corp. He succeeds L. W. Haskell, who has resigned.

Vincent Bendix has resigned as board chairman and a director of Bendix Aviation Corp., which he helped incorporate in 1929. **E. R. Breech,** a vice-president of General Motors, succeeded Bendix as president of Bendix Aviation Corp., Feb. 24.

W. S. Scruggs has been elected a vice-president of St. Paul Hydraulic Hoist Co., Minneapolis. He will continue as general manager.

Harold P. Wade, formerly assistant chief engineer at Packard Motor Car Co., has been named head of the Detroit engineering office of Adel Precision Products Corp., of Burbank, Cal.

Warren H. Clarke, Michigan director of the Contract Distribution Branch, War Production Board, has resigned, effective early in April, to take a position with Houdaille-Hershey Corp. He has been head of the Detroit office of the contract service since March 27, 1941, when it first opened.

J. D. Van Valkenburgh has been appointed assistant to the president of Irvington Varnish & Insulator Co. He was formerly associated with Johns-Manville Corp.

R. W. Aiken has been named plant engineer of the Jessop Steel Co. **John Wilson,** formerly superintendent of the sheet mill, has been promoted to Production Superintendent.

A. Donally Armitage was elected president, **E. J. Wilcox,** vice-president in charge of stock product sales, **Willard C. Kress,** vice-president in charge of all manufacturing of J. H. Williams & Co. **Hugh Aikman** was re-elected secretary and **Clark M. Fleming** treasurer. Mr. Fleming was also elected a director of the company to fill the vacancy left by the death of J. Harvey Williams, the late president.

S. G. Baits, first vice-president of the Hudson Motor Car Co., has become general manager of the U. S. Naval Ordnance Plant at Centerline which is being operated by the company under lease agreement with the Navy Department. **H. M. Northrop,** for many years chief engineer, has been promoted to a vice-presidency and placed in charge of the company's business which is being conducted in its Detroit automobile plants. **M. H. Toncray,** formerly in charge of the engineering department's body division, has become chief engineer. **E. A. Taylor** has been appointed works manager of the Detroit automobile plants, and **L. K. Rosenberg** will assist him. Both Taylor and Rosenberg were formerly with the Yellow Truck & Coach Mfg. Co.

Harry T. Mitchell, formerly vice-president and manager of the Detroit office of J. Stirling Getchell, Inc., has resigned. **Randolph W. Heiser,** the agency's account executive serving the White Star Division of Socony-Vacuum in Detroit, becomes manager of the Detroit office.

GM War Program

(*Continued from page* 46)

able planning for the past seven years in conjunction with supplying the Army's many motor vehicles with parts.

A vast training program also will be undertaken by the corporation directed by John E. Johnson, formerly sales manager of General Motors of Canada, Ltd. GM will help maintain schools for Army and Navy instructors who in turn will train the huge number of mechanics that will be required in this mechanized war. A fleet of 60,000 airplanes as visioned by President Roosevelt calls for enormous ground crews and 40,000 tanks also will require a great force of mechanics.

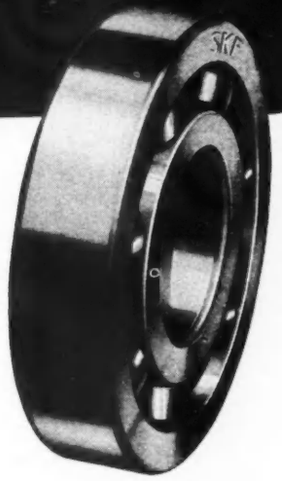
The GM participation in this training program will cost at least $5 million in 1942. It is estimated it costs $10 per week per man to train instructors. Allison and Chevrolet have operated training schools for Army instructors for some time. The Dept. of Training Service will operate schools for 10 GM-designed products, including trucks, diesel engines, tanks, Allison aircraft engines, and propellers, and for 10 products designed outside the corporation which GM is producing, including radial aircraft engines, various size guns, airplanes, and torpedoes.

GM Institute will train men to staff divisional schools. GM also will cooperate with the Armored Force Training Center at Fort Knox, Ky., training 25 men per month as diesel engine instructors for tank work. Allison Division already has given more than 800 Air Corps instructors from the U. S., Canada, Great Britain, New Zealand, and China a one to three-month training course in maintenance of the Allison liquid-cooled engine.

Another a.c.f. *bus doing its bit on* SKF *Bearings*

SKF

BALL AND ROLLER BEARINGS



Defense

WORKERS *move on* SKF's

Moving defense workers from home to factory and back again on time is a big job for buses these days. And that's what you find a.c.f. buses doing day after day, month after month, without bearings causing costly delays by wanting oil or attention. Inside them, SKF Ball Bearings are keeping shafts in proper position, making moving parts turn smoothly, insuring more miles per dollar. In Transportation today, *performance* is the thing that counts.

4954

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILADELPHIA, PA.

Discuss Production Drive

(*Continued from page* 47)

Recommendation by the national executive board of the CIO that double time pay on Sundays and holidays be eliminated when it comes within the 40-hour week was expected to clarify that issue in the GM-union negotiations. A decision by the GM umpire, G. Allan Dash, Jr., that the GM contract could not be interpreted as waiving double time pay for Sunday work because war work could not be excepted due to the technical nature of the continuing process involved had prompted GM to ask that the double time clause be eliminated in the revised contract. The union had countered with the demand that Armistice Day be added to the present list of six double time holidays and that Saturday work be paid time and one-half. Dash's decision required GM to pay double time retroactively for all Sunday work which had begun in certain plants where the swing shift had already been put into operation.

Another union demand is an increase in wages every 90 days based on the cost of living index. A similar plan is in effect in Canada but there there is a ceiling on wages, which were "frozen" as of last fall's level. A $100 defense bond, costing GM $75, is sought in place of the present annual vacation bonus of 40 hours' pay, which approximates $45 at current standards. Sixty days' pay is sought for employes entering the military service in place of the present 80 hours' pay. GM has 8000 former employes in the armed services. Relative to the wage increase, GM average annual earnings for hourly rated employes was $2,141 in 1941, a 13 per cent gain over the $1,804 average in 1940. GM average annual earnings in 1941 were 43 per cent higher than that prevailing in all manufacturing plants and 29 per cent higher than that paid in the 25 major manufacturing industries.

General Motors proposals for revision of the contract are designed, according to Wilson, to improve morale, more clearly define certain working plans and methods of pay, restore incentives in the plants properly to compensate individual workmen who increase their output and revise the practical handling of labor relations so that there will be more work and less talk.

Specific proposals of the corporation include discontinuance of attacks in union papers and literature that accuse GM of "speedup methods" and undermine employe morale, elimination of double-time pay for the duration, recognize the management's right to establish any system of shifts which may be necessary to speed up war production and withdrawal of union opposition to the introduction of individual piece work or other incentive methods of pay designed to step up war production. The corporation also asks that promotions to better jobs be on the basis of merit, ability, and performance rather than straight seniority, that the number of committeemen handling complaints be reduced by 50 per cent, and that investigation of the same complaint by numerous committeemen be discontinued.

Wilson called the union's proposals "business as usual." Walter P. Reuther, head of the GM Dept. of the UAW-CIO, applied the same term to the GM proposals.

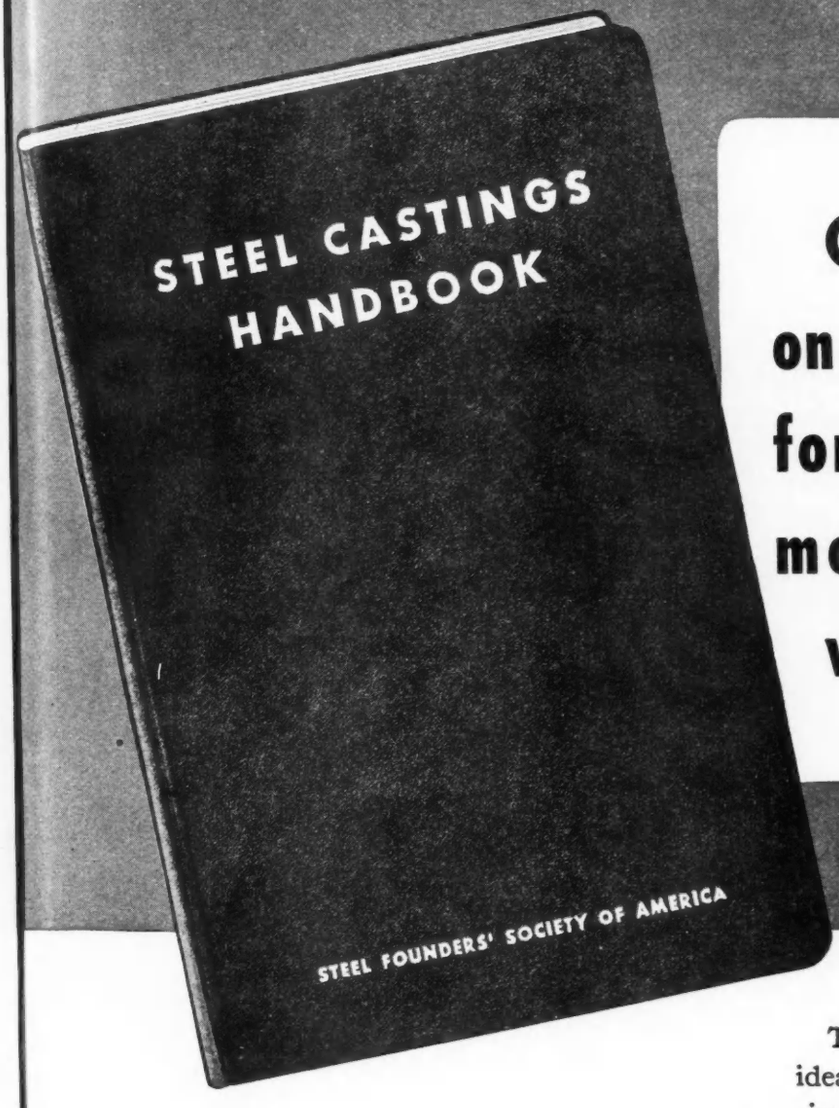
Agree to Rescind Price Increases

The four major rubber companies have agreed to rescind price increases put into effect Janary 1, 1942, on tires sold as original equipment for automobiles and trucks of all types, and to rebate to customers the amount collected in excess of the December 31, 1941, level.

Similar action was taken by the four companies—Firestone Tire and Rubber Co., The B. F. Goodrich Co., Goodyear Tire and Rubber Co. and U. S. Rubber Co.—in mid-January in regard to original equipment tires sold to manufacturers of farm machinery and equipment.

Study of original equipment tire prices will continue with particular reference to the tire companies' operating experience in January and February. The OPA has indicated its willingness to approve price advances whenever actual cost and earnings figures make increases necessary.

SEND FOR THIS NEW BOOK



Complete Data on Steel Castings—for better, quicker, more economical war production

The new Steel Castings Handbook, just off the press, summarizes the experiences of hundreds of engineers, designers, metallurgists and steel foundrymen. It is the most complete handbook on Steel Castings ever compiled—conveniently arranged for quick reference—well illustrated, attractively printed and durably bound.

The book contains over 500 pages of facts, ideas, tables, charts and illustrations—all designed to help you manufacture a better and more modern product, often at a substantial cost saving. It should be on your desk or in your library right now.

Ask your foundryman to show you the New Steel Castings Handbook, and tell you how to secure your personal copy. The book is valued at $2.00 per copy, postpaid, and the supply is limited. Steel Founders' Society of America, 920 Midland Bldg., Cleveland, Ohio.

MODERNIZE YOUR PRODUCT WITH

STEEL CASTINGS

Huge Machine Tool Problem of Conversion

(*Continued from page* 17)

types in its Detroit office. Only 1800 machines, or 5 per cent, were found to be completely idle. Another 7000 machines, or 20 per cent, were found to be idle more than half the time. The remaining 26,700 machines were in operation more than half the time, either on war work or making replacement parts. In the six weeks since the inventory began, companies reported that 1600 machines which originally were idle or in part-time use have been converted to 100 per cent war production operations.

Three men in the Automotive Branch handle requests from more than 100 companies daily for machine tools and other factory equipment needed for war production. The daily requests total between 1200 and 1500 machine tools. Greatest of current shortage in machines appears to be internal and external grinders and milling machines of certain sizes. Other machines on the "critical" list of the Automotive Branch are horizontal boring machines, jig boring machines, vertical boring machines, chamfering machines, hobbing machines, deep hole drilling machines, radial drilling machines, turret lathes, gear grinding machines, toolroom lathes, thread milling machines, engine lathes (24-in. and up), planers (36 in. and up), multiple spindle automatics, profiling machines, rifling machines, bar machines, rifle reaming machines and thread grinding machines.

Companies making requests for machine tools are referred to other companies having idle equipment, if such is available. In some cases where there is an acute shortage, they are advised by War Production Board engineers to seek similar equipment which can be adapted to do the particular job. No record is kept of the machines transferred because the companies seeking the equipment deal directly with the owners. Lift trucks, heat treat furnaces and cranes have been obtained for war contractors as well as machine tools through this service.

One notable example was a heavy press which the A. O. Smith Corp., of Milwaukee, needed for the manufacture of airframe parts. A check by the Automotive Branch revealed that only six of these presses had been manufactured in the last 15 years. One of these six was located at the Budd Wheel Co. in Detroit. Formerly used in making automobile hub caps, it had been converted to war production. However, the Budd company agreed to shift the war work to other machinery and to sell the press to the A. O. Smith Corp. to fill a vital role in aircraft production. The 235,000-lb. press was sold to the Milwaukee firm for $50,000.

The Automotive Branch has been able to channel "critical" machinery into the most urgent jobs. A heavy-duty turret lathe recently was delivered to a Detroit plant but was transferred to a nearby plant where it was needed more urgently. General Motors obtained four milling machines that were needed for manufacture of Diesel engines.

The card index of the Automotive Branch lists the "critical" machines in five categories; (1) those now in use on war work, (2) those allocated to war work on the basis of contracts signed or letters of intent, (3) those allocated to war work on the basis of bids submitted, (4) those engaged in replacement parts production, (5) those available for war work on prime or subcontracts, and (6) those available for sale or lease. The number of hours that the machines are in operation daily and the end products also are listed.

The Automotive Council for War Production has undertaken to list all the machine tools in the automotive industry. Up to mid-March about 50,000 machine tools had been listed by 200 companies. When reports are received

THIS actual occurrence (dates, locations, identification, must of necessity be withheld) affords a striking demonstration of the remarkable consistency of performance characteristic of Stromberg Injection Carburetion.

Fuel consumption is steady, predictable, and runs astonishingly true to form in like engines of like airplanes.

Other attributes of this modern carburetion are: automatic continuous self-adjustment to proper fuel-air mixture for all altitudes, employing fixed-size metering jets; very appreciable fuel economy; a resultant increase in the airplane's flying range and load capacity; simplification of field service work because of the virtually identical basic design used on various engine models.

BENDIX PRODUCTS DIVISION
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INJECTION CARBURETOR

from all of the approximately 100 companies in the industry employing more than 500 workers, it is estimated that 90 per cent of the machine tools in the industry will be listed. The machine tool census is expected to be completed by mid-April. Some companies have been unable to send in their reports because they have not yet completed their machine tool assignments on the huge amount of war contracts that were awarded to the industry after Pearl Harbor.

The Automotive Council has the machines listed under their present status in categories similar to those used by the Automotive Branch of the WPB. Upon receipt, cards are classified by a staff of 12 clerks under a uniform machine tool classification developed by General Motors Corp. This information is then transferred to punch cards under the Hollerith system and the data can be sorted automatically by tabulating machine in any one of more than half a dozen breakdowns.

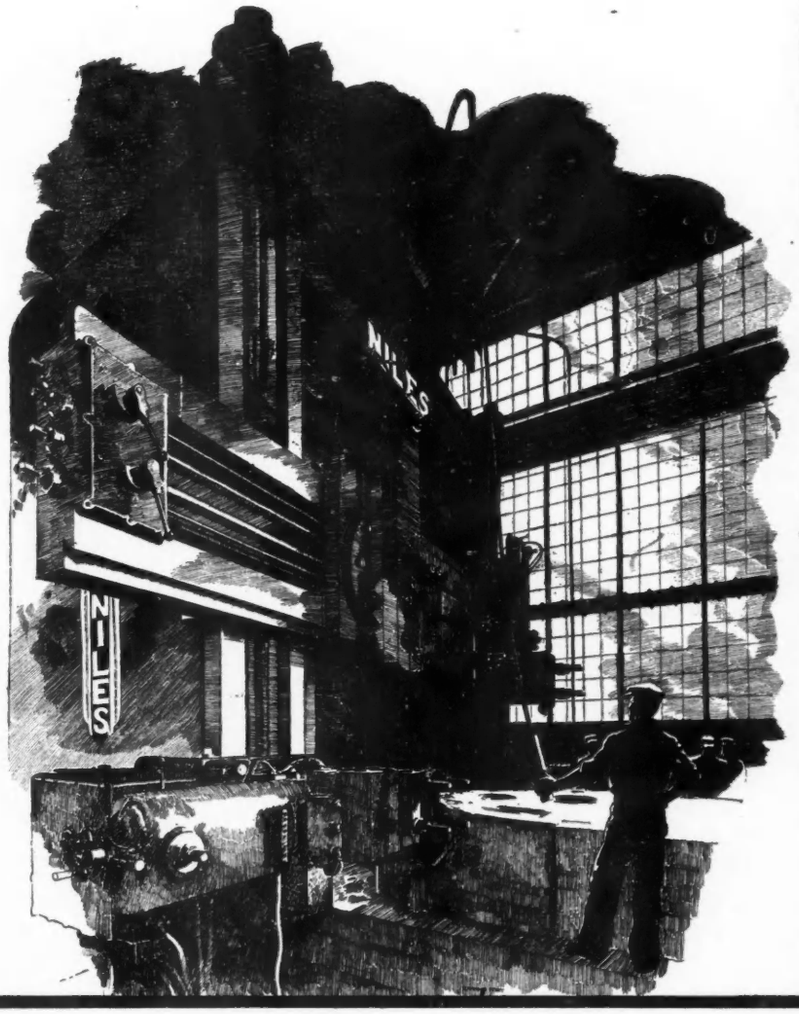
There has been considerable transfer of machines through the Automotive Council listing service, according to William J. Cronin, who is in charge of that activity. Two huge stamping presses of more than 200 tons capacity were located at the Packard Motor Car Co. and sold to a railroad shop in Pennsylvania which needed them to make armored trains. A shipbuilding company in Mississippi obtained some welding machines from an automotive company. A manufacturer of hypodermic needles located several much needed grinders in the automotive industry. Automatic screw machines and heavy presses are particularly in demand. The aircraft industry has called upon the Automotive Council for help. A spotting press recently was shipped from an automobile plant to a West Coast airplane company.

The Tooling Information Service of the Automotive Council also has been active. Weekly reports are sent out to automotive firms listing the available idle capacity of automotive tool and die shops and the type of work, such as gages, jigs, fixtures, tools, cutting tools and dies. Three hundred and seventy-one companies have listed their tool and die facilities with the service, of which 79 had excess capacity available. Two hundred and ninety-six companies sent in lists of their tool and die requirements for new war contracts. The tool shop of National Automotive Fibers, Inc., which had no door panel or upholstery work to do when passenger car production ceased, obtained a subcontract for naval ordnance work from Hudson Motor Car Co. through the Automotive Council. A small Detroit tool and die shop located some gun machining from a Cleveland company that will keep it busy for many months after a tooling order for the Ford bomber plant had been filled.

A major problem of the big automotive companies like General Motors, Ford and Chrysler, with plants located in all parts of the nation, has been that of classifying and coordinating their machine tool facilities. These companies previously had their machines and factory equipment cataloged on a plant or divisional basis, which was adequate for automobile and truck production. But when the war program necessitated the utmost use of a corporation's facilities, these companies had need for a central index of their machinery.

Realizing the growing implications of the national defense program, General Motors began a corporation-wide inventory of the machine tool facilities in its 38 divisions and 90 plants early in 1941. Harold T. Johnson, formerly master mechanic at Cadillac, was made director of standards and began the inventory with a small staff in Detroit. A card was made out for each machine tool in each plant and these were sent to the Standards Section for tabulation.

One of the biggest difficulties that Johnson encountered was the lack of a uniform classification for machine tools. So a uniform machine tool classification system was devised that may well become a standard for the industry. The Automotive Council for War Production is using this classification system and the Ford Motor Co. also has adopted it in bringing its machine tool inventory up-to-date. It should prove

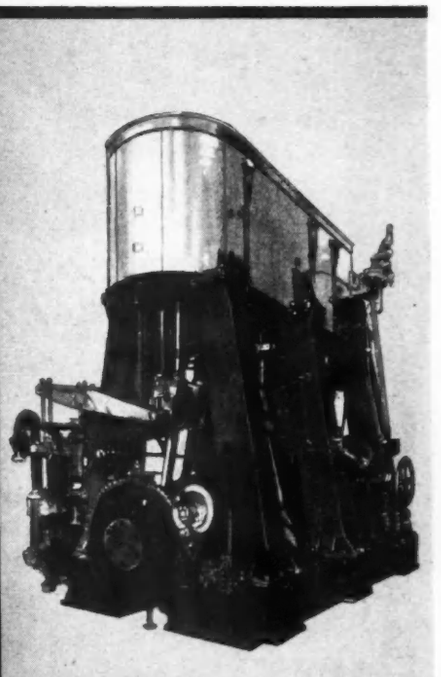


The FIRST shall be LAST

NEARING completion, far ahead of the production schedule, is an order for massive planers to be used in finishing the heaviest armor plate for America's warships. The parts for these huge machines are seldom made in quantities except in time of war and the equipment for mass production of such items is very scarce. We have such equipment in our shops but, at the time this order was placed, all of it was working 24 hours a day on orders for steam engines to be used in the Liberty Ships and large machines for defense production. So we borrowed equipment time from the Liberty Ships order to machine the heaviest parts of the first planer. Then we set it up in our own shops and used it to machine these same parts for the balance of the order. This move speeded up the planer order by months.

The first planer finished will be the last one shipped, but the last shipment on the order will be weeks ahead of our own schedule, many months ahead of any schedule which could have been set up otherwise.

This resourcefulness which assumes such importance in times of war is also important in times of peace. It has enabled General Machinery to serve the Nation well through five wars. It has kept the wheels turning in times of peace. It will again be at the service of American Industry when the war is over and the ways and workings of peace are resumed.



● 2500 h. p. triple expansion steam engine used in LIBERTY Cargo Ships

GENERAL MACHINERY CORPORATION

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GENERAL MACHINERY ORDNANCE CORPORATION

THE NILES TOOL WORKS CO. • THE HOOVEN, OWENS, RENTSCHLER CO.

valuable in the inter-change of information between companies and makes for clearer understanding between engineers in discussing machines.

GM has prepared a 34-page manual which explains its machine classification methods to the various plants. Machine tools have been segregated as to type and kind of machine and identified by a classification number. An alphabetical prefix is used to identify the class of machine and a numerical suffix to denote the type of machine. Thus H denotes a drilling machine, K a grinding machine, J a gear machine, O a milling machine and S a press. There are 101 general classifications, which include foundry machines, rubber working machines and special war machinery as well as general machine tools. In the interest of uniformity, a Keller machine is listed as a "Milling machine—profiling."

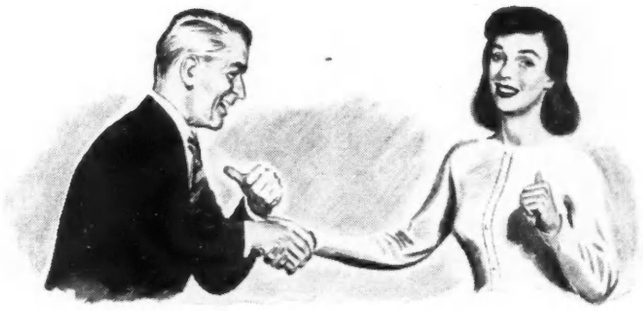
The numerical suffix denotes the type of machine. If the letter is followed by the number 1, it is horizontal, 2 is vertical, 3 is automatic and 4 is special purpose equipment. Thus, O-3 is an automatic milling machine. Other numbers denote type variations in machinery. Forty-one types of presses are listed, from "Arbor manual" to "Wiring and Tapering—long stroke." There also are 34 types of grinding machines, 18 types of drilling machines, 17 varieties of milling machines and 10 different welding machine types.

Other information reported on each machine to the Standards Section is the trade name, size, plant location, use (production, tool room or maintenance), condition, ownership (GM, U. S. Government or Defense Plant Corp.), drive (motor, belt, hand or foot), motor information (voltage and cycles), year of manufacture and year of purchase. Any additional data on special attachments, number of spindles, etc., also is listed. All this information is recorded on a uniform machine tool classification card which is filed by the Standards Section after a Hollerith card is made out for each machine to facilitate a quick tabulation of the corporation's machine tools on any needed breakdown basis.

Three types of tags are affixed to machines in the plant to make it possible to tell at a glance the particular assignment of that machine. A red, white and blue tag is affixed if the machine is assigned to war work and the particular assignment, along with other necessary data, is listed. A yellow tag indicates the machine is producing service parts, while a green tag denotes tool room, maintenance or experimental work. Unassigned machines are not tagged. A duplicate stub at the bottom of each tag is detached and sent to the Standards Section whenever the general status of a machine changes. This keeps the record up-to-date in the Standards Section and the corporation knows what machine tools are idle and available for war work, either within or without the corporation.

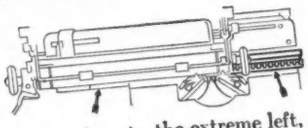
General Motors now has more than 70,000 machine tools listed in its Standards Section. An average of 50 machines per week are now being transferred from one plant to another for war work. This number is expected to increase as more war contracts pass from the blueprint to the tooling stage. GM had operated a surplus machinery listing service for many years and in 1941 a total of 1350 machines were shifted from one plant to another through this service. The present rate of transfer is nearly double the 1941 rate.

Chrysler Corp. began a centralized listing of all machine tools in the corporation's 19 manufacturing plants in United States about three years ago. This card index, which is kept up-to-date at the Chrysler Highland Park plant in the office of Don Flater, Chrysler master mechanic, lists more than 20,000 machines in the corporation. Ford also is engaged in bringing its machine tool inventory up-to-date for war production purposes. The smaller automobile companies like Packard, Hudson and Studebaker, with most of their manufacturing facilities concentrated in one place, have centralized machine tool listings, which have been filed with the Automotive Council for War Production.



My boss and I are in there pitching!

Here's what I do every morning



1. Run carriage to the extreme left, and wipe carriage rails or "tracks" (upper and lower) with dry cloth. Repeat operation after running carriage to the extreme right. At the same time wipe carriage roll or rail, on the back of the machine.

2. Wipe slots in segment (that's the curved metal frame work in which the type bars move) with dry cloth—wiping towards you so as to clean thoroughly.

3. Clean type, using bristle type-brush. If you do this daily you can keep your type perfectly clean without using gasoline or benzine. Should you find it necessary to clean type with a cleaning fluid, use it very sparingly.

P.S.—Don't forget it pays to buy the finest typewriter ribbons and carbon papers. Be sure to specify Roytype*—they're made by Royal.

IN OUR BUSINESS, my boss and I need typewriters . . . but so does the Government. And right now, Uncle Sam comes first.

Our Armed Forces and Civilian Defense need thousands and thousands of typewriters. Uncle Sam is ordering typewriters so fast that it's hard for a man like my boss to buy a new machine. But that's all right—we'll just make the typewriters we have *last longer!*

My boss asked the Royal Typewriter Company how to make a typewriter last longer, and they sent us a few simple rules. I follow these rules every day, with the result that my machine *runs smoother* and *easier*, is more fun to work on. It will require *fewer repairs, less servicing*, and the boss won't have to worry about replacing it nearly so soon.

Here's what I do once a week

1. Hold paper table or paper deflector forward, and wipe off nickel rods with a cloth slightly moistened with a little oil.

2. Clean out carriage rails or "tracks" using same cloth slightly moistened with a little oil.

3. Clean cylinder or roller with a cloth moistened with a little denatured alcohol. (This is important as it will prevent paper from slipping.) Do not use benzine or gasoline for cleaning roller.

MR. EXECUTIVE: Have the stenographers and secretaries in *your* office follow the above simple rules. It is also to your advantage to sign a Maintenance or Service Contract with the Royal Typewriter Company or its sales representative. Under these contracts, obtained on a 1, 2, or 3-year basis, Royal promises to inspect, clean, and adjust your typewriters four times a year, and to replace *free* all worn-out parts, other than rubber parts. Call your local Royal representative *today!*

ROYAL
World's Number 1
TYPEWRITER

*Trademark Reg. U. S. Pat. Off.

Metal Cleaning as of Today

(*Continued from page* 44)

tank cleaning is rapidly and economically installed. The cleaners supplied by leading manufacturers are speedy and free rinsing."

Sun Oil Co., producers of mineral spirits for metal cleaning, advise that—"Important industrial defense plants are finding they can use Sunoco Spirits and Sun Mineral Spirits in a variety of ways. The parts may be placed in wire baskets and dipped into the spirits in an open tank. The number of rinses required depends upon the cleanliness desired, and also the original state of the parts before being dipped. These parts are then oven-dried at not too high a heat—or air-dried through the medium of compressed air. Another use that has been found for Sunoco Spirits is to saturate a cloth with the Mineral Spirits and then clean the parts or surfaces by wiping this cloth over them. This picks up dirt, grime and grease and leaves the parts sparkling clean.

"At the present time, there are many types of mechanical cleaning machines on the market. Some are specially designed for the chlorinated cleaners and cannot be converted directly to the use of Mineral Spirits—that is, the heating or vaporizing stage would have to be eliminated to prevent any fire hazard. Manufacturers changing over to Mineral Spirits on mechanical washers would do well to consult the manufacturer from whom they purchased the machine or the local salesman who supplies them with Mineral Spirits."

A report from the Magnus Chemical Co., emphasizes a new metal cleaning procedure which has had the benefit of wide commercial usage. Quoting from this report—"The fundamental principle of the Magnus Emuls-Dip or Emulso-Spray method is that Magnusol brought in contact with the dirts present, puts them in readily rinsable condition; their adhesion to the metal is destroyed. Magnusol—an emulsifiable solvent provided in the form of a concentrate—is mixed with kerosene or safety solvent in the proportion of one part Magnusol to eight to twelve parts of kersoene. This mixture is either sprayed on the objects to be cleaned or the objects are dipped in it.

"The time of dipping or the length of time the sprayed objects are in contact with this solution is relatively short ($\frac{1}{2}$ minute). The solution possesses exceptional penetrating powers and not only dissolves the greases and oils present on the surface of the metal to be cleaned, but penerates rapidly to the metal surface, loosening the bond between the dirt and the metal and changing the dirt deposit into a condition in which it is readily removed in the next stage of the process. This consists in subjecting the work to a pressure spray rinse with water. This water stream not only knocks loose all traces of dirt, but it emulsifies the cleaning solution, together with the dirt, into a readily rinsable form.

"The Magnus Emulso-Dip adaptation of this method involves a dipping operation of fractional minute durations, followed by the regular pressure spray to rinse off the emulsion and all the dirt. This spraying operation can be carried on in a simple still tank, followed by a booth or tank for spraying. Existing metal cleaning machines can frequently be adapted for this system, but in cases where the volume of materials to be handled is large or where the existing equipment would require too extensive changes, the Magnus Chemical Company is prepared to design and build suitable machines for the use of the Magnus Emulso-Dip method.

"The Magnus Emulso-Spray system, depending on the same principle, utilizes a spraying system to apply the cleaning solution instead of the dipping method, again followed by an ordinary pressure water rinse. As in the case of the Emulso-Dip method, this system can be adapted to existing metal washing machines."

Oakite Products, Inc., comments on the fact that during World War I, mil-

lions of shells, cartridge cases, and small arms ammunition were cleaned with Oakite materials. In addition, "these same Oakite materials, all of an alkaline type, were used for cleaning a multitude of various types of ordnance materiel and other essential war supply items manufactured of various metals such as iron, steel, brass, copper, bronze, aluminum, etc. And from these war supply items in production, it was essential to remove every conceivable kind of oil, grease, smut, direct, etc." Today, this company makes over 60 different specialized cleaners designed for specific metal cleaning tasks.

"The experienced companies who have specialized in the manufacture of industrial cleaning materials, are in a position to supply immediately a range of cleaning materials which will give high performance on practically all production or maintenance cleaning operations. This is particularly true in the important field of war production metal cleaning. While some plants have in the past scheduled their metal cleaning operations on the basis of trichlorethylene, the lack of that product will not handicap their cleaning operations in their production schedule. One of the alkaline type or non-chlorinated industrial cleaning materials immediately available can carry on the cleaning operations without serious interruption.

"In making the changeover it will, however, be necessary to study the type of article being manufactured, the kind of grease, oil, or foreign matter to be removed, and the subsequent operations so as to select the most effective cleaning material. There may also need to be some revision of equipment which, however, is not of major nature nor difficulty, but is essential in obtaining fast and efficient cleaning from the alkaline type specialized Oakite materials. In that connection, the changeover will be most effectively accomplished by utilizing the services of a trained service man who is experienced in selecting and working out the details of application of these specialized cleaning materials."

Producers of both chlorinated solvents and alkaline cleaners, the Pennsylvania Salt Mfg. Co., is in a unique position to see the picture clearly. Commenting on the effects of a possible shortage of chlorinated solvents, this company observes that "Metal fabricators, perhaps, are conjuring up visions of having to install entirely new equipment, thus scrapping their present solvent degreasing equipment in order to change over from the use of chlorinated solvents to alkaline cleaners. It is true that some of the present equipment will have to be set aside temporarily, but in many instances it will be found possible to convert such equipment to pressure spray washers or immersion tanks in which alkaline cleaners can be used. Of course, certain jobs will continue to require chlorine type cleaners and for these there should be an ample supply of chlorinated solvents if proper cooperation is shown between the user and the supplier on those many applications that can be handled with alkaline cleaners.

"Another problem with which we are confronted is the memory that some metal fabricators may have of the use of alkaline cleaners during the first World War. At that time, Caustic Soda, Soda Ash, Trisodium Phosphate and mixtures of these were about the only alkalis available for use in cleaning. However, in the past ten years tremendous progress has been made in the alkaline field; for example, the various sodium silicates such as the meta, sesqui and more recently, the ortho, have been developed. In fact, the majority of proprietary cleaners on the market today contain silicates in one form or another. Also literally hundreds of surface active or wetting agents have been developed, which have made a distinct contribution to the efficiency of present day alkaline cleaners. The polyphosphates also should be mentioned as developments which are contributing much to improved alkaline compounds.

"In addition to the progress that has been made by alkali companies themselves, a distinct and important contribution has been made by manufacturers of equipment in which alkaline cleaners

can be more efficiently used and by the comprehensive research which all alkaline cleaner suppliers are always carrying on in the interest of new and better means of utilizing the many outstanding characteristics and properties of alkalis, especially the more recently developed materials such as the silicates, polyphosphates and surface active agents."

American Chemical Paint Co., makes several specific recommendations—the first is the use of alkali cleaners, since they are cheaper and satisfactory for most purposes, although somewhat more floor space is required for the alkali cleaning process.

The second recommendation is the use of Deoxidene which has been so widely employed in metal cleaning in the industry in past years. This process would remove not only the oil coating but rust, dirt, and rust stimulators as well.

Where cold tank metal cleaning is feasible, the Curran Corp., offers its Gunk Concentrate, a self-emulsifying degreasing solvent which is said to be particularly effective in the cleaning of ordnance and ammunition components. Due to a powerful emulsifying and scouring action attributed to Gunk, it is claimed that in addition to cleaning the surface, oil is actually extracted for minute pores of the metal, leaving the surface in the proper condition for painting or finishing. The process also is said to act as a rust inhibitor.

The brief sampling of recommendations from specialists in the field of metal cleaning given above provides an excellent perspective of the wide scope of materials and techniques available for the gamut of metal fabrication problems. It is wise to observe that there is no universal metal cleaner or metal cleaning process. Each type has its place, depending upon the kind of metal to be cleaned, the nature of the contaminants to be removed, the element of productivity, and the nature of the process for which the metal surface is to be prepared.

Each plant should make an immediate study of its metal cleaning problems by placing it in the hands of a competent staff metallurgist or chemist. Then follow this with a survey and recommendations by the specialists in the metal cleaning field. If you have degreasing equipment, start by calling in the manufacturer of your equipment. Then supplement his advice with recommendations by suppliers of other types.

Following is a composite list of companies included in Chilton Automotive Buyer's Guide under the headings "Cleaners, Metal" and "Solvents, Oil and Grease."

American Chemical Paint Co., Ambler, Pa.
Bell Co., Chicago, Ill.
Bennett, Inc., Cambridge, Mass.
Blakeslee & Co., G. S., Cicero, Ill.
Bruce Products Corp., Detroit, Mich.
Buchanan Chemical Co., C. G., Cincinnati, Ohio.
Bullard Co., Bullard-Dunn Div., Bridgeport, Conn.
Calcine Chemical Co., Jersey City, N. J.
California Co., San Francisco, Calif.
Carpenter-Morton Co., Boston, Mass.
Circo Products Co., Cleveland, Ohio.
Creative Chemical Co., Pittsburgh, Pa.
Curran Corp., Malden, Mass.
Dearborn Chemical Co., Chicago, Ill.
Detroit Rex Products Co., Detroit, Mich.
Dow Chemical Co., Midland, Mich.
du Pont de Nemours & Co., E. I., Grasselli Chemicals Dept., R. & H. Chemicals Division Refinish Sales Dept., du Pont Bldg., Wilmington, Del.
Esso Marketers, New York, N. Y.
Ford Co., J. B., Wyandotte, Mich.
Gerlach Co., E. A., Philadelphia, Pa.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Harshaw Chemical Co., Cleveland, Ohio.
Homestead Valve Mfg. Co., Hypressure Jenny Div., Coraopolis, Pa.
Houghton & Co., E. F., Philadelphia, Pa.
Industrial Chemical Products Co., Detroit
International Chemical Co., Philadelphia
I-Sis Laboratories, Inc., Stamford, Conn.
Kelley Co., J. W., Cleveland, Ohio.
Ki-Sol Corp., St. Louis, Mo.
Lake Erie Mfg. Co., Buffalo, N. Y.
Lavo Co. of America, Milwaukee, Wis.
Magnus Chemical Co., Garwood, N. J.
Mapor Corp., New York, N. Y.
Montgomery Co., H. A., Detroit, Mich.
Oakite Products, Inc., New York, N. Y.
Park Chemical Co., Detroit, Mich.
Pawling Refining Corp., Port Chester, N. Y.
Pennsylvania Salt Mfg. Co., Philadelphia
Philadelphia Quartz Co., Philadelphia
Quigley Co., New York, N. Y.
Rhodes & Co., James H., Chicago, Ill.
Service Supply Co., Denver, Colo.
Socony-Vacuum Oil Co., New York, N. Y.
Stain-Ox Co., Roselle, N. J.
Standard Oil Co. of Calif., San Francisco
Standard Oil Co. of Texas, San Francisco
Stanley Co., John T., New York, N. Y.
Sun Oil Co., Philadelphia
Sure-Rite Products Corp., Philadelphia
Turco Products, Inc., Los Angeles, Calif.
Udylite Corp., Detroit, Mich.

Looking to Latin America for Rubber

(*Continued from page* 36)

survived, of which 100,000 are being tapped experimentally. In 1934 part of the Fordlandia acreage was exchanged by the Brazilian government for a 703,750-acre tract 84 miles down the Tapajoz River, near its confluence with the Amazon. This new plantation, known as Belterra, is on a 500-ft. plateau where constant breezes minimize attacks by the leaf blight. High-yielding stock from the Far East was imported and crossed with some of the disease-resistant strains developed at Fordlandia as the basis for the Belterra plantings. This plantation now numbers 2,960,000 young rubber trees, of which about 33,000 have reached the experimental tapping stage. Prolonged dry spells in Brazil delay the maturity of the trees about two years, compared to Malaya.

Only 23,000 acres of the huge Ford holdings have been planted to rubber, lack of labor being a restricting factor. Ford has built more than 900 buildings on the two plantations, including model villages, hospitals, schools, churches, radio stations and powerhouses. There are now 3000 workers on the two plantations, but more are needed if the development is to proceed on any large scale. The present plantings will produce approximately 750 tons of crude rubber in 1942, about 2 per cent of Ford's rubber requirements in a normal automotive year. It is estimated that annual production will reach 7500 tons by 1950. To supply all Ford's automotive rubber needs will require at least 76,000 acres of trees.

U. S.-Brazilian cooperation in exploiting the natural resources of the Amazon Valley, as discussed by Sumner Welles, Assistant Secretary of State, and President Getulio Vargas, of Brazil, at the recent Pan-American conference in Rio de Janeiro may have an important bearing on the further development of this rubber-growing area. Potential capacity of wild rubber production in the Amazon region is estimated at 75,000 tons, compared to a previous peak of 38,000 tons in 1910 and only 19,000 tons in 1941, of which 5000 tons were shipped to the United States.

Brazil has established an agricultural institute at Belem, where rubber plant research already is one of the major activities. Dr. E. W. Brandes, chief of the rubber division of the Department of Agriculture, along with several other U. S. experts in the field, have visited Belem and cooperated on experimental work. Almost a million rubber seedlings are now growing at the institute preparatory to making Brazil again a major producer of the world's rubber. There are approximately half a billion wild rubber trees in the Amazon River basin area, but many of them are in inaccessible jungle regions where transportation and labor are utterly lacking. The low production costs and consequent lower price of Far Eastern rubber has discouraged any wide exploitation of Brazil's wild rubber supply. The Amazon alone is known to have 37 tributaries along which are rubber-producing trees, but varying navigation conditions complicate the problem.

Population of the vast 2,250,000 sq. mi. of the Amazon Valley is estimated at less than one person to the square mile. Most of Brazil's 43-million inhabitants live in the southern half of the country. Importation of labor has been suggested, especially from Puerto Rico, but Brazil's immigration laws prohibit the entrance of more than 2 per cent of the number of immigrants from any country in the last 50 years. This practically limits any mass migration of workers except Portuguese, who have comprised the bulk of the newcomers to Brazil in the last half century. Supervisors at the Ford plantations have combed the surrounding country for hundreds of miles trying to obtain

more workers to live in the model communities there.

The southern states of Mexico such as Tabasco, Yucatan, Campeche, Chiapas and Vera Cruz are suitable to growing of "hevea" trees, but Mexico's land laws have discouraged any recent attempts at large scale rubber cultivation by private capital. The government under the Mexican constitution has the right to break up large private land holdings. However, in cooperation with the U. S. Department of Agriculture, an experimental nursery has been set up in Chiapas state, which may encourage native production on a crop sharing basis. Nearly 10,000,000 "hevea" trees were planted in Chiapas prior to 1910, mostly backed by U. S. capital, but leaf blight and competition of cheaper far eastern rubber prevented any lasting development.

This time it is hoped that the development of Para rubber in the Western Hemisphere is on a sounder basis. With the cooperation of the United States Government and such far-sighted companies as Ford, Firestone and Goodyear, it is not unlikely that within a decade the rubber-growing areas of Latin America will be supplying this nation with a major share of its rubber requirements.

Sterling Engine Production for War Boats

(*Continued from page* 30)

even microscopic surface defects.

Following current airplane engine practice, the inspected engines coming off the final assembly line are first run-in in the test cells, then are torn down for inspection, re-assembled, and given the final acceptance run.

Due to the sub-contracting set-up, mentioned above, we have found it expedient to provide a visualization of the manufacture of the Admiral engine chiefly by means of a pictorial presentation with brief details in each caption. These illustrations represent a sampling of activity in the Sterling plant as well as in the plants of some of the sub-contractors.

As an example of production practice, it is of interest to note that the Aero-Thread thread form of the studs for the Admiral engine performs a most important duty since the studs are required to tie together the entire engine from the crankcase to the cylinder head. The stud end is screwed into the aluminum alloy crankcase which is fitted with Aero-Thread bronze inserts. It is imperative that the thread form be accurate in every respect to insure a class 5 fit.

Accordingly, these studs are ground on an Ex-Cell-O No. 33 thread grinding machine, cutting the threads with a high speed cutting wheel, the shape of which must conform exactly to the Aero-Thread form. This is accomplished by the movement of two small diamonds which dress the wheel 0.005 in. after each complete cut.

Two cuts are required—rough and finishing—producing an excellent surface finish, perfectly round, concentric in every respect and a perfect fit for the insert in the tapped hole to provide for a given torque when the stud is finally driven into the crankcase.

Nickel-Sized Plastics Disks

NICKEL-SIZED molded plastic disks made of Lucite methyl methacrylate resin are said to give "maximum reflection of light from minimum candle power." Available in crystal, amber, red and green, they are useful in the construction of arm bands, belts, directional signals and signs marking danger spots. Very light in weight, the disks may be nailed, riveted, screwed or wired in place. The reflectors are injection molded for the Lumelight Corporation of New York from Lucite produced by the Plastics Department of E. I. du Pont de Nemours & Co.